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GENERAL

4015 TID-5059(3rd Rev.)
Technical Information Service Extension, AEC.
CORPORATE AUTHOR ENTRIES USED BY THE TECHNICAL INFORMATION SERVICE IN CATALOGING REPORTS. Frances E. Stratton, ed. Nov. 1957. 305p. $6.50(OTS).

Atomic Bombs and Warfare

4016 ITR-1447
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE INTERNAL ENVIRONMENT OF UNDERGROUND STRUCTURES SUBJECTED TO NUCLEAR BLAST. I. THE OCCURRENCE OF DUST. Preliminary Report. Clayton S. White, Mead B. Wetherbe, and Vernon C. Goldizen. Sept. 1957. 69p. $2.00(OTS).

The possible occurrence of dust inside protective shelters as a consequence of nuclear explosions was studied using 18 underground structures subjected to atomic detonations during Operation Plumbbob at distances ranging from 4320 to 840 ft from Ground Zero. The existence of considerable dust was established using sticky-tray fallout collectors. Particulates captured arose from dust on the floor existing preshot, from dust leaks in some shelters, and from the internal surfaces of the structures. The latter was established by treating the walls and ceilings of selected shelters with a fluorescent dye solution and subsequently demonstrated fluorescence of captured particles. Data available indicate that the dust-collector technique will be useful in evaluating the environmental aspects of shelters tested in the future and that procedures showing fine spalling may be more sensitive indicators of structural response to dynamic loading than gross spalling. Should this indeed be established, the fluorescent method employed, or an equivalent, will become another simple routine test available to indicate structural response at greater ranges than is now possible without using complicated instrumentation. (auth)

4017 ITR-1451
Ammann and Whitney, New York.
RESPONSE OF PROTECTIVE VAULTS TO BLAST LOADING. Preliminary Report. E. Cohen and E. Laing. Sept. 1957. 39p. Project 30.4 [of] OPERATION PLUMBBOB.

A reinforced-concrete steel-plate-lined vault and steel vault door were exposed to a nuclear detonation. The recorded peak incident pressure at the structure was approximately 92 psi. To aid postshot analyses, soil borings were made to obtain undisturbed samples for determining soil characteristics. Preshot and postshot field surveys were made to determine the total lateral and vertical displacement of the structure. Blast instrumentation consisted of Wiancko shock pressure gauges and a dynamic-pressure gauge. Structural response was not recorded. Thermal instrumentation consisted of a thermocouple on the front face of the vault, two peak-temperature gauges, and a spring-wound stylus 24-hr temperature recorder on the interior of the vault. Radiation measurements were made using film dosimeters and gamma-radiation differential chemical dosimeters. (auth)

4018 ITR-1469
Lovelace Foundation for Medical Èduction and Research, Albuquerque, N. Mex.
TERTIARY EFFECTS OF BLAST — DISPLACEMENT. Preliminary Report. R. V. Taborelli and I. G. Bowen. Sept. 1957. 36p. Project 33.3 [of] OPERATION PLUMBBOB. $1.00(OTS).

Measurements were made of the velocity and distance of translation of anthropomorphic dummies and equivalent spheres caused by blast winds. The primary technique for recording the movement of these objects was photo-triangulation. The secondary technique (applicable to certain of the equivalent spheres) was to have the spheres impelled into missile traps. The resultant penetration provides a means for determining the velocity at the time of impact. Analysis of the results from both the primary and secondary techniques is expected to provide some of the information identified in the objective. (auth)

4019 ITR-1507
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE INTERNAL ENVIRONMENT OF UNDERGROUND STRUCTURES SUBJECTED TO NUCLEAR BLAST. II. EFFECTS ON MICE LOCATED IN HEAVY CONCRETE SHELTERS. Preliminary Report. D. R. Richmond, T. L. Chiffelle, R. T. Sanchez, and J. D. Ward. Sept. 1957. 29p. Project 33.6 [of] OPERATION PLUMBBOB. $1.00 (OTS).

Mice were used to assess biologically the inside environment of two designs of heavy concrete personnel structures subjected to nuclear blast. A sample consisted of 20 mice; one sample was used in each of 12 structures. Aside from two samples placed in unrealistic locations, there was no immediate mortality. By D+20 days two mice from the close-in shelters and seven from those further out had died. (auth)

Atomic Power

4020 WASH-740
Division of Civilian Application, AEC.
THEORETICAL POSSIBILITIES AND CONSEQUENCES

OF MAJOR ACCIDENTS IN LARGE NUCLEAR POWER PLANTS. Mar. 1957. 114p. $0.65(GPO).

Assuming a typical power reactor of 500 tMw in a characteristic location, theoretical calculations were made of the effects of the worst possible reactor accidents. Both personal and property damage as a result of the initial accident and the subsequent fission product release are evaluated. The possibility of a catastrophic reactor accident was also evaluated and found to be extremely unlikely. (D.E.B.)

4021

THIRD PARTY LIABILITY IN NUCLEAR INDUSTRY. P. Sacerdoti. Energia nucleare (Milan) 6, 495-511(1957) Dec. (In Italian)

Following a general review of the safety and hazards problems in nuclear industry and research, the problem is dealt with from an insurance point of view. All questions concerning limits and costs of coverages on behalf of private companies, limits of liability in time, legal limits of operators' liability are examined. (auth)

4022

HOW WE FIND SITES FOR NUCLEAR POWER STATIONS. G. N. Stone (Central Electricity Generating Board). New Scientist 3, 26-9(1958) Jan. 2.

A number of factors such as water supply, abundance of coal, and population, which influence the location of nuclear power stations in England are reviewed. (D.E.B.)

4023

ECONOMICS OF ATOMIC ENERGY. Mary Goldring. London, Butterworths Scientific Publications, 1957. 193p.

The growth of Britain's nuclear power is discussed. The volume is broken down into three parts which are: the atomic industry (the atomic factories, the tools of industry, and the scale of investment); atomic power (the need for power, cost of atomic power, and export market); and atomic investment (British pattern, atoms and industry, other countries methods, and Britain's atomic future). (W.L.H.)

4024

THE APPLICATION OF ATOMIC ENGINES IN AVIATION. Edited by V. A. Mikhailov. Military Publishing House of the Department of Defense. Moscow, 1957. 167p. (In Russian)

A compilation of published data on applications of nuclear power plants in aviation and in rockets is given in popular form. Various aspects of nuclear reactors—their performance, the fuels used, and their prospective applications in aviation and in interplanetary flight—are discussed. The flight of aircraft propelled by chemical and nuclear energy and the complications involved in construction of nuclear aircraft reactors are analyzed. Designs of aviation nuclear power plants are shown, including rocket engines, air-cooled engines, turbojets, turboprops, etc. Radiation hazards and protection involved in nuclear powered aircraft and servicing problems in flight as well as the nuclear aircraft take-off and landing characteristics are described. Interplanetary flight, altitude and speed performances, advantages of nuclear rocket engines, and a program for attaining cosmic velocities are discussed. (R.V.J.)

Research Programs

4025 NP-6529

Australia. Commonwealth X-Ray and Radium Lab., Melbourne.

ANNUAL REPORT FOR THE YEAR ENDED JUNE 30, 1957. D. J. Stevens. Sept. 1957. 22p.

The Commonwealth X-ray and Radium Laboratory serves as the national center for radiological physics in Australia. The Laboratory provides advisory services on physical problems arising in the use of radium, x rays, and radioisotopes and also serves as a repository and dispersing center for radium, radon, and radioisotopes. Activities engaged in during the period are summarized. (C.H.)

BIOLOGY AND MEDICINE

4026

EFFECT OF ARTIFICIAL CHANGES IN EGG COMPOSITION ON HATCHABILITY AND CHICK GROWTH. Arthur H. Smith, Ursula K. Abbott, and Muriel E. Jones (Univ. of California, Davis). Proc. Soc. Exptl. Biol. Med. 97, 17-20(1958) Jan.

Radiation Effects

4027 AD-123944

Michigan. Univ., Ann Arbor. Fission Products Lab.

GAMMA-RAY SPROUT INHIBITION OF POTATOES. Report No. 10 (Annual) [for] Period November 1, 1955–October 31, 1956. L. E. Brownell. 94p. Project No. 7-84-01-002. Contract DA-19-129-qm-349.

Sebago variety potatoes given as little as 5,000 rep of γ radiation show no signs of sprouting, but Russett Rurals given 20,000 rep show occasional evidence of arrested sprout development. Tiny sprouts (1 mm) form but do not proliferate. Nonirradiated potatoes, except those stored at 35°F, show definite sprout development. Most of the potatoes, irradiated and nonirradiated, except those stored at 35°F, show slight softening, usually confined to the skin. Weight losses during storage for irradiated and control Sebago and Russet Rural variety potatoes were determined as a function of radiation dose, temperature of storage, and duration of storage. 19 references. (auth)

4028 AF-SAM-57-150

Texas. Univ., Austin. Radiobiological Lab. and School of Aviation Medicine, Randolph AFB, Tex.

POSTIRRADIATION CREATINURIA IN MACACA MULATTA MONKEYS. George M. Krise, Clyde M. Williams, and Donald R. Anderson. June 25, 1957. 4p.

Four adult male Macaca mulatta monkeys were placed on a creatine-free diet for seven to nine days. After the urinary level of creatine excretion had reached a plateau, the animals were irradiated with 1,000 rep of x rays. A creatinuria of approximately four times normal was excreted over the first four days in a pattern similar to that previously found in the rat. On the second postirradiation day the average creatinuria was about seven times normal. This effect is compared with other species reported in the literature. (auth)

4029 AF-SAM-58-1

Northwestern Univ., Chicago. Medical School.

EFFECTS OF SINGLE AND OF SPACED, MULTIPLE DOSES OF COBALT-60 GAMMA AND FISSION NEUTRON RADIATION ON THE INCORPORATION OF IRON-59 INTO THE RAT ERYTHROPOIETIC SYSTEM. W. A. Rambach, J. A. D. Cooper, and H. L. Alt. July 5, 1957. 17p.

4030 AMRL-273

Army Medical Research Lab., Fort Knox, Ky.

THE ROLE OF CERTAIN ORGANS IN FRACTIONATED TOTAL BODY X-IRRADIATION STUDIES. J. G. Kereiakes, W. H. Parr, and A. T. Krebs. Oct. 22, 1956. 14p. Project No. 6-59-08-014. (AD-125586).

Intervals between each of five 140 r doses of 1, 3, 5, 7, and 9 hours resulted in survivals of 15, 35, 55, 45, and 40%, respectively, for fractionated total-body x irradiation of

mice. A 700 r single dose was 100% lethal. The pattern of the intestinal dry weight response to fractionated doses was similar to that for survival. Fractionating the dose did not seem to significantly alter the 700 r single dose spleen wet weight value. The findings suggest that the fast recovery of the mitotic process and of the nucleic acid metabolism in the small intestine at about five hours after irradiation with doses between 100 and 200 r may be responsible for the observed results for the five hour interval fractionated total-body x irradiated mice. (auth)

4031 NP-6532

Office of the Adjutant General, Washington, D. C.
FOOD PRESERVATION IN THE ATOMIC AGE. A Selected List of Titles. [1956]. 10p.

Bibliographic Series No. 3.

A list of over 100 titles was compiled covering general aspects of preserving food by means of irradiation. Most of the papers have been published since 1952. (C.H.)

4032 NYO-2081

Columbia Univ., New York. Radiological Research Lab.
ANNUAL REPORT ON RESEARCH PROJECT. July 1, 1957. 128p. Contract AT-30-1-GEN-70.

Radiological Physics. Measurements of the tissue doses produced by radioisotopes variously distributed were continued. The average energy lost by S^{35} β rays per ion pair produced, or W, was determined to be 33.6 ± 0.3 ev. The value of W for water vapor relative to air was measured for β rays from S^{35} and from Ni^{63}. A new method for determining the disintegration rate of K-capture isotopes from their γ rays was tested with Au^{198}. A tissue-equivalent ionization chamber was developed and tested. Progress was made in applications of tissue equivalent ionization chambers for neutron dosimetry. Investigations were made of the mechanism of production of spontaneous and radioinduced mutants in E. coli. Radiobiology. Research in progress is summarized briefly. Progress is reported in studies on the protective effect of splenic plasma injected intraperitoneally into irradiated rabbits; the effect of hibernation and tranquilizing drugs on radiosensitivity of mice; the effect of radiation on the gonads in mice; and the effects of radiation on the developing mouse fetus. Lists are included of research published and submitted for publication during the period. (For preceding period see NYO-4698.) (C.H.)

4033 UR-493

Rochester, N. Y. Univ. Atomic Energy Project.
STUDY OF SMALL AREA SUB-FABRIC FLASH BURNS. K. M. Berkley. Aug. 29, 1957. 36p. Contract W-7401-eng-49. $1.00(OTS).

In a series of 1850 exposures with a modified 24-in. carbon arc searchlight, the influence of two cotton poplin fabrics alone and in combination with underwear material on the energy required to produce 2+ cutaneous burns in swine were studied. Impregnation of both khaki and green poplin with fire retardant material reduced the amount of energy necessary to produce a 2+ burn below that required with the untreated material, when the fabrics were spaced 2 and 5 mm from the skin. As a fabric is separated from the skin, the amount of absorbed energy required to produce a 2+ sub-fabric burn increases in a linear relationship with the amount of spacing. Maximum protection was provided by a two layer combination of poplin and underwear separated by a 5 mm air space. The energy required to produce a 2+ burn beneath two fabric layers separated by 5 mm decreased as the exposure time increased. With two layers spaced 2 mm, the requirements were the same. (auth)

4034 UWFL-49

Washington. Univ., Seattle. Applied Fisheries Lab.
RADIOACTIVITY IN THE REEF FISHES OF BELLE ISLAND ENIWETOK ATOLL APRIL 1954 TO NOVEMBER 1955. Arthur D. Welander. May 17, 1957. 42p. Contract AT(45-1)-540. $1.25(OTS).

Studies of the radioactivity in reef fishes of Belle (Bogombogo) Island, Eniwetok Atoll, were made during a period of about one year following the atomic detonations in 1954. Thirty-four different collections were made and 693 specimens were analyzed to determine the trend or decline of radioactivity. The decline of radioactivity during the period under study was generally similar in all species. The relative amount of radioactivity per gram of tissue was greatest in the alimentary tract, with the liver, skin, bone and muscle having successively lesser amounts. This relationship prevailed throughout the period. The rate of decline was greatest during the first 100 days, with a loss of 90% of the radioactivity during the period. Studies were made on the variation of total radioactivity in the tissues and species, on comparisons of the amount of radioactivity in the species and in their food, and on comparisons of the decline of radioactivity during the period with the decay of radioactivity in tissues collected soon after the shots. (auth)

4035 AEC-tr-3089

STUDIES ON LEUCOCYTOSIS AND LEUCOPENIA OBSERVED ON THE BASIS OF THE MITOSIS OF NUCLEATED CELLS IN THE BONE MARROWS. Tokuji Miyamoto. Translated from Acta Haematol. Japan. 18, 647-58(1955). 41p.

4036 NP-tr-10

EFFECTS OF RADIOACTIVE GOLD (Au-198) ON THE BONE MARROW. Theodor M. Fliedner and Rudolf Stodtmeister. Translated by B. Smith from Strahlentherapie 101, 289-95(1956). 5p.

4037 NP-tr-11

THE HAEMATOLOGICAL BASIS FOR THE ESTIMATION OF RADIATION SHIELDING PRECAUTIONS. Three Years of Radiation Haematological Research at the Czerny Hospital, Heidelberg University. R[udolf] Stodtmeister, Theodor M. Fliedner, and S. Sandkühler. Translated by B. Smith from Strahlentherapie 101, 296-307(1956). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 3291.

4038 NP-tr-12

THE SIGNIFICANCE OF PARIETAL VESSEL LESIONS FOR HAEMATOPOIESIS INJURY TO RATS AFTER TOTAL BODY IRRADIATION OF 15 MeV ELECTRONS. R[udolf] Stodtmeister, S. Sandkühler, and Theodor [M.] Fliedner. Translated by B. Smith from Strahlentherapie 101, 308-17 (1956). 10p.

4039 NP-tr-17

THE EFFECT OF ULTRA-VIOLET RAYS ON THE ALBUMEN SUBSTANCES OF MILK SERUM. Theodor Fr. Hellbrugge, Lotte Scheid-Seydel, and Hubert Martin. Translated by F. Hudswell from Z. Kinderheilk. 70, 1-9(1951). 13p.

4040 NP-tr-21

THE EFFECT OF X-RAYS ON INTERNAL ORGANS. H. Heineke. Translated by F. Hudswell from Münch. med. Wochschr. 51, 785-6(1904). 6p.

4041

EFFECT OF X-IRRADIATION ON THE FUNCTION OF ADRENAL AUTOTRANSPLANTS IN THE RAT. Leland C. Wyman, Rae Whitney, Ralph F. Goldman, Patricia L.

Griffin, and Donald I. Patt (Boston Univ., Mass.). Am. J. Physiol. 192, 51-7(1958) Jan.

4042
TUMOR OF THE BONE TISSUE INDUCED BY RADIOACTIVE SUBSTANCES. N. N. Litvinov. Bull. Exptl. Biol. Med. (U.S.S.R.) 41, 703-7(1956) Aug.

4043
CHANGE IN CEREBELLUM TISSUE METABOLISM WITH IRRADIATION BY X-RAYS. A. V. Golubtsova, E. V. Moiseenko, and M. I. Safronova (M. V. Lomonosov State Univ., Moscow). Bull. Exptl. Biol. Med. (USSR). 41, 763-6(1956) Sept.

4044
ACCELERATION OF ORGAN FORMATION IN PLANTS BY X RADIATION. I. M. Vasil'ev (Inst. of Biological Physics, Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 401-3(1957) Sept. 21. (In Russian)

4045
EFFECTS OF X RADIATION ON THE DUODENUM AND THE INTRAMURAL GANGLIA OF PLEXUS MYENTRICUS (AUERBACHI) AND PLEXUS SUBMUCOSUS (MEISSNERI). L. B. Levinson, N. V. Pankova, and N. I. Shapiro. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 116, 404-6(1957) Sept. 21. (In Russian)

Studies were made of the order of the alterations in the nerve tissues induced by radiation in various organs. Comparisons were made of the charges taking place in the epithelium capillary cells, in the Brunner glands, and in the nerve cells in the intestinal intramural ganglia. Changes in the nerve cells induced by exchange disturbances were studied in mice, and determination was made of the disoxyribonucleic acid, ribonucleic acid, and alkali and acid phosphatase. (R.V.J.)

4046
EFFECTS OF POTASSIUM CYANIDE ON THE SURVIVAL OF IRRADIATED ANIMALS. N. V. Luchnik and E. A. Timofeeva-Resovskaya (Inst. of Biology, Urals Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 407-10(1957) Sept. 21. (In Russian)

4047
THE CYTOLOGY OF THE IRRADIATED OVARY OF DROSOPHILA MELANOGASTER. R. C. King (Northwestern Univ., Evanston, Ill.). Exptl. Cell Research 13, 545-52(1957) Dec.

4048
EFFECTS OF ANDROGENS ON THE CYTOLOGY OF X-IRRADIATED SEMINAL VESICLES. W. Fleischmann (Veterans Administration Hospital, Memphis, Tenn.). Exptl. Cell Research 13, 604-7(1957) Dec.

4049
DYE UPTAKE AND SURVIVAL STUDIES IN X-IRRADIATED YEAST CELLS. A. J. Luzzio and J. G. Kereiakes (U.S. Army Medical Research Lab., Fort Knox, Ky.). Exptl. Cell Research 13, 615-17(1957) Dec.

4050
IONIZING RADIATION AND HUMAN HEREDITY. N. P. Dubinin (Laboratory of Radiation Genetics, Inst. of Biophysics, Acad. of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Biol., 743-55(1957) Nov.-Dec. (In Russian)

4051
FATE OF SKIN HOMOGRAFTS IN X-IRRADIATED MICE TREATED WITH HOMOLOGOUS MARROW. Joan M. Main and Richmond T. Prehn (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 19, 1053-64(1957) Dec.

4052
AMYLOIDOSIS IN MICE EXPOSED TO DAILY GAMMA IRRADIATION. S. Lesher, D. Grahn, and A. Sallese (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 19, 1119-31(1957) Dec.

4053
LONG-TERM STUDY OF X-IRRADIATED RABBITS WITH BONE-MARROW HOMOTRANSPLANTS. K. A. Porter and J. E. Murray (Harvard Medical School and Peter Bent Brigham Hospital, Boston, Mass.). J. Natl. Cancer Inst. 20, 189-205(1958) Jan.

4054
HYPERLIPOPROTEINEMIA AND CHOLESTEROL DEPOSITION AT THE ARTERIES OF I^{131}-TREATED DOGS. Lawrence J. Milch, A. A. Renzi, Norman Weiner, Lesly G. Robinson, and Sherman S. Wilson (Randolph Air Force Base, Texas). Proc. Soc. Exptl. Biol. Med. 97, 56-9(1958) Jan.

4055
URINARY EXCRETION OF URIC ACID AND ALLANTOIN BY THE X-IRRADIATED-ADRENALECTOMIZED RAT. Kenneth L. Jackson and Cecil Entenman (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Proc. Soc. Exptl. Biol. Med. 97, 184-6(1958) Jan.

4056
POTENTIATING EFFECTS OF PRENATAL X-IRRADIATION ON DENTAL CARIES IN THE RAT. B. H. Ershoff and and L. A. Bavetta (Univ. of Southern California, Los Angeles). Proc. Soc. Exptl. Biol. Med. 97, 202-5(1958) Jan.

Radiation Hazards and Protection

4057 APEX-348
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
METHOD OF ESTIMATING DOSAGE TO GROUND FROM A RADIOACTIVE CLOUD. C. C. Gamertsfelder and R. L. Waterfield. Oct. 1955. 27p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.00(OTS).

Beginning with Sutton's diffusion equation, the authors develop mathematical expressions for the radiation dose to a point on the ground following the instantaneous emission of a point source of radiation. From a knowledge of weather conditions, reactor running history, and the power of the runaway, one can compute the beta and gamma dose to be expected from the following events: material inhaled into the lung; direct and scattered radiation from material in the air; and direct and scattered radiation from material deposited on the ground by rain–out or fall–out. (auth)

4058 KAPL-1869
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR APRIL, MAY, JUNE 1957. 40p. Contract W-31-109-Eng-52. $1.25(OTS).

Routine personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1831.) (C.H.)

4059 KAPL-1889
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR JULY, AUGUST, SEPTEMBER 1957. 43p. Contract W-31-109-Eng-52. $1.25(OTS).

Personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1869.) (C.H.)

4060 NAVSHIPS-250-348-1
Bureau of Ships.
GENERAL PRINCIPLES OF IONIZING RADIATION. Roger G. Preston. June 1, 1955. 37p.

This information is intended for personnel only occasionally associated with the fields of nuclear power and atomic warfare. These notes are divided into three chapters: the nature of ionizing radiation, the detection and measurement of ionizing radiation, and the biological effects of ionizing radiation. (M.H.R.)

4061 USNRDL-TR-193
Naval Radiological Defense Lab., San Francisco.
EFFECTS OF DONOR AND HOST LYMPHOID AND MYELOID TISSUE INJECTIONS IN LETHALLY X-IRRADIATED MICE TREATED WITH RAT BONE MARROW. G. W. Santos and L. J. Cole. Dec. 1, 1957. 30p. Project NM 006 015.04.

4062
PROTECTIVE EFFECT OF 2-MERCAPTOETHYLGUANIDINE ON BONE MARROW CELLS X-IRRADIATED IN VITRO. L. H. Smith (Oak Ridge National Lab., Tenn.). Exptl. Cell Research 13, 627-30(1957) Dec.

Radiography

4063 AFOSR-TR-57-95
Ohio State Univ. Research Foundation, Columbus.
PRODUCTION OF CLINICAL ROENTGENOGRAMS BY MEANS OF COMPACT RADIOACTIVE X-RAY AND GAMMA-RAY SOURCES. Final Report. H. D. Spangenberg, Jr. and M. L. Pool. Oct. 1957. 35p. RF Project 610. Contract AF18(600)-1305. (AD-136752).

New and known radioactive isotopes were synthesized and investigated which emit x rays and/or low energy gamma rays suitable for roentgenographic visualization of the teeth and their supporting structures. Data on the following isotopes were collected: Ce^{144}, Eu^{155}, Sm^{145}, La^{137}, Dy^{157}, Dy^{159}, Yb^{169}, Gd^{161}, and Tb^{157}. The difficulties encountered in the preparation of any one of the above radioactive substances, in sufficiently pure form, make it impossible to designate any single activity as the ideal source for all types of low energy radiography. Ce^{144} and Sm^{145} have acceptable characteristics and their use has resulted in good quality radiographs. (auth)

Radiotherapy

4064 NP-tr-9
RADIOACTIVE YTTRIUM Y^{90} AS A SOURCE OF RADIATION FOR INTRAPERITONEAL AND INTRAPLEURAL APPLICATION. K. E. Scheer. Translated by F. Hudswell from Strahlentherapie 101, 283-8(1956). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 3320.

Tracer Applications

4065 AEC-tr-3088
CHANGES IN BONES INDUCED BY THE INTRODUCTION OF RADIOACTIVE STRONTIUM INTO RATS. L. A. Cherkassky. Translated from Voprosy onkologii 2, 275-84 (1956). 15p.

4066 NP-tr-4
SUPPLY OF RADIOACTIVE ISOTOPES TO THE PLANT BY WAY OF THE LEAVES. I. V. Gulyakin and E. V. Yudintseva. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. 111, 709-12(1956). 8p.

4067
OCCURRENCE OF AN UNKNOWN RADIOACTIVE SUBSTANCE AFTER SHORT-TIME PHOTOSYNTHESIS IN $C^{14}O_2$. O. Kandler (Univ. of California, Berkeley). Arch. Biochem. Biophys. 73, 38-42(1958) Jan.

4068
UPTAKE OF RADIOACTIVE PHOSPHORUS IN EXPERIMENTAL TUMORS. II. EFFECT OF VASCULARITY ON RADIOACTIVE UPTAKE IN NEOPLASTIC, INFLAMMATORY, AND NORMAL OCULAR TISSUE. Charles I. Thomas, Mary Sue Bovington, Jack S. Krohmer, J. W. MacIntyre, and J. P. Storaasli (Western Reserve Univ. School of Medicine and Univ. Hospitals, Cleveland, Ohio). Cancer Research 17, 1091-7(1957) Dec.

CHEMISTRY

Refer also to abstract 4582.

4069 CCC-1024-TR-271
Callery Chemical Co., Penna.
REACTION OF POTASSIUM BOROHYDRIDE WITH BORON TRIFLUORIDE. R. K. Pearson, L. L. Lewis, and L. J. Edwards — P. M. Maginnity, ed. Dec. 4, 1957. 10p. Project ZIP. Contract NOa(s)-52-1024-c.

A study was made of the potassium borohydride–boron trifluoride reaction to determine the feasibility of replacing sodium borohydride with a more readily available borohydride in the sodium borohydride–boron trifluoride preparation of diborane. Although potassium borohydride is much less soluble than sodium borohydride in diethylene glycol dimethyl ether, a 91% yield of diborane was obtained in this reaction. A potassium borohydride-borane complex, analogous to $NaBH_4BH_3$, apparently either does not form or is too unstable to be a significant intermediate. (auth)

4070 CCC-1024-TR-272
Carnegie Inst. of Tech., Pittsburgh.
CATALYTIC PYROLYSIS OF DIBORANE. R. B. Beckmann — P. M. Maginnity, ed. Dec. 9, 1957. 21p. Project ZIP. For Callery Chemical Co. Contract NOa(s)-52-1024-c.

The feasibility of catalyzing a directed pyrolysis of diborane to higher boron hydrides, by means of commercially available catalysts, was investigated. The results indicate that the usual metal catalysts such as Ni, activated Al_2O_3, and Pt have some catalyzing properties. The data, unfortunately, are too meager to demonstrate whether or not this catalysis is directional for the desired liquid products. With the solid catalysts tested it was always found that solid degradation products eventually stopped the reaction. The runs made to determine whether or not gas phase catalysis might occur due to the presence of methyl radicals from organic methyl compounds were inconclusive, but generally the results appeared negative. (auth)

4071 CF-53-5-172(Rev.)
Oak Ridge National Lab., Tenn.
COST ESTIMATE CHECK LIST FOR A NEW PROJECT. W. G. Stockdale. Nov. 25, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An itemized list for capital and operating cost is presented to be used as a guide in estimating costs for a new project. The availability of cost indices, to relate the value used from listed cost to a current basis, is included. (W.L.H.)

4072 LA-1649
Los Alamos Scientific Lab., N. Mex.
PHYSICAL PROPERTIES OF NICKEL CARBONYL. K. A. Walsh. Nov. 24, 1953. Decl. Jan. 13, 1958. 14p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

The vapor pressure of nickel carbonyl was determined with material obtained by laboratory preparation with CO and Ni powder and by purifying commercial nickel carbonyl. The observed vapor pressure data were used in the derivation of the following equations which express the vapor pressure, P, of liquid nickel carbonyl and the sublimation pressure, P_s, of the solid, respectively, as a function of the absolute temperature, T: $\log P = 7.8843 - 1578/T$ and $\log P_s = 10.1897 - 2173/T$. The average heat of vaporization is calculated to be 7.22 ± 0.01 kcal per mole and the molecular heat of sublimation of $Ni(CO)_4$ is 9.94 ± 0.11 kcal. Extrapolation to 760 mm Hg gives a boiling point of 42.2°C. The melting point of purified nickel carbonyl occurred at −17.2°C. The sensitivity of the melting point to the effect of impurities was demonstrated with commercial nickel carbonyl which melted at −19.4°C before purification, at −18.3°C after distillations at 0°C, and at −17.2°C after sublimation at −25°C. The vapor pressure of liquid nickel carbonyl at 0°C is of little value in evaluation of the purity of the material. (auth)

4073 NAA-SR-2124

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

BASIC CHEMISTRY OF HIGH TEMPERATURE INORGANIC SYSTEMS. Semiannual Progress Report [for] January–June 1957. S. J. Yosim and T. A. Milne. Dec. 15, 1957. 37p. Contract AT-11-1-GEN-8. $1.25(OTS).

High Temperature Thorium Chemistry. Emphasis on the thorium vapor-pressure studies has shifted to Langmuir-vaporization experiments on inductively-heated thorium disks; preliminary results are given. The vapor-pressure determinations of solid and liquid ThF_4 were completed; the vapor pressure and derived thermodynamic quantities are presented. Studies of the products and equilibrium pressures in the $SiO_2 + ThF_4$ reaction are being continued so that the stability of ThF_4 may be determined. Nearly anhydrous $Th(NO_3)_4$ was synthesized and initial decompositions were carried out. Chemistry of Metal–Metal Salt Systems at High Temperatures. The solubility experiments of the $Bi-BiCl_3$ system in the two-liquid phase region were completed. The miscibility gap was found to be closed at a consolute temperature of 780°C and 50 mole % Bi. A retrograde solubility of the metal in the salt was also established. Additional solubility data for the $Cd-CdCl_2$ and $Cd-CdI_2$ system were obtained. The solubility of the metal in the salt increased with temperature to 27% for Cd in $CdCl_2$ at 960°C and to 29% for Cd in CdI_2 at 870°C. Solubility studies of $HgCl_2$ in Hg reveal a continuous increase of solubility with temperature up to 6.8 mole % at 559°C. Cryoscopic work on metal–metal salt systems was extended to studies of the following solvents: $BiCl_3$, CdI_2, and Cd. Bismuth dissolved in $BiCl_3$ yielded a cryoscopic number of 0.5. Cadmium dissolved in CdI_2 gave a cryoscopic number of one. Freezing point depressions of Cd by CdI_2 and $CdCl_2$ indicate very little solubility of the salts in Cd. Cryoscopic measurements indicate that $BiCl_3$ is selectively dissolved in Bi. High Temperature Chemistry of Ceramics. Vaporization studies have been carried out on La_2O_3 and BeO in tungsten containers by Knudsen techniques and evidence of reaction with tungsten was found in both cases. Vaporization data based on assumed gaseous species are presented. Langmuir measurements were made on ZrC and Knudsen measurements were made on ZrC and Be_2C. The data were interpreted to yield thermodynamic stabilities for these compounds. The requisite x-ray intensity data for the three-dimensional analysis of BeO were obtained from diffraction photographs of a single crystal of BeO. A high-temperature, high-pressure apparatus was assembled for use in the attempted synthesis of new ceramic compounds. An x-ray study of the ZrO_2-UO_2 system indicated that ZrO_2 and UO_2 form a single solid solution above 1875°C and that the addition of 15% UO_2 to ZrO_2 lowers the tetragonal to monoclinic transformation from 1000°C to below room temperature. (auth)

4074 NYO-6675

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.

AN INVESTIGATION OF THE CHEMICAL NATURE OF THE ORGANIC MATTER OF URANIFEROUS SHALES. Annual Report Covering the period January 1 to December 31, 1956. Dept. of Fuel Technology. C. R. Kinney, R. L. Broadhead, J. T. Leonard, T. J. Roessing, and F. J. Vastola. Sept. 30, 1956. 36p. Contract AT(30-1)-1442. $6.30(ph OTS); $3.00(mf OTS).

Semiannual report NYO-6674 containing work completed from October 1, 1955 to March 31, 1956 is an integral part of this Annual Report.

4075 NYO-7542

Tufts Univ., Medford, Mass.

THE REACTION OF ALUMINUM HYDRIDE WITH 3d TRANSITION METAL HALIDES. Progress Report [for] March 17, 1955 to November 1, 1955. M. John Rice, Jr., T. R. P. Gibb, Jr., and Edward G. Meloni. Nov. 1, 1955. Decl. Jan. 13, 1956. 19p. Contract AT(30-1)-1355. $3.30(ph OTS); $2.40(mf OTS).

The reactions of AlH_3 in ether and in tetrahydrofuran solution with anhydrous halides of Fe, Co, and Ni are described. Reactions were carried out anaerobically at room temperature and below. In all instances, finely divided black products were obtained, some of which may contain metal to hydrogen bonds. Analytical results are presented for more than forty reactions, and possible mechanisms are discussed in a preliminary way. Observations are reported on the magnetic behavior of the products from Fe and Ni halides. The product from $NiBr_2$ reduction gave an x-ray-diffraction pattern similar to that of NaBr. (auth)

4076 WADC-TN-57-308

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

CRITIQUE ON THE ANALYTICAL REPRESENTATION OF SPECIFIC HEAT DATA. Period covered: January 1957 to August 1957. Richard Pawel. Aug. 30, 1957. 19p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: THERMAL MEASUREMENTS. (AD-142095).

A considerable lack of agreement exists in the literature for high-temperature specific heat values. Since the majority of these data have been obtained indirectly through enthalpy measurements, the problem of data treatment is added to those of the experiment. It is thought that the present uncertainties in the methods of curve fitting the enthalpy data can yield misleading trends to the resulting specific heat curves. For this reason, it appears wise to consider the final result in the light of simple specific heat theory and the accuracy and reproducibility of the original enthalpy data. The complexity of the analysis should be based upon the reliability of the enthalpy data to avoid "over-fitting." It appears that in the absence of exceptionally precise enthalpy data, a quadratic expression will satisfactorily describe the data, resulting in a linear specific heat representation. This simple representation is sometimes more compatible than those obtained by other means. (auth)

4077 AEC-tr-2889

POLYMERIZATION AND OTHER TRANSFORMATIONS OF ETHYLENE AND PROPYLENE UNDER THE ACTION OF HEAT, FREE RADICALS, AND OTHER ACTIVE PARTICLES. Ya. T. Eidus and K. V. Puzitskii (Puzitsky).

Translated from Uspekhi Khim. 22, 838-77(1953). 98p.

Polymerization reactions of ethylene and propylene under the action of heat, electric discharges, excited metal atoms, free atoms, and radicals are presented. (W.L.H.)

4078 AEC-tr-3107

EXCERPT FROM "THE ALLEGED ISOMERISM OF POTASSIUM CHLORO SALTS." R. Charonnat. Translated by K. S. Bevis from Ann. chim. (10) 16, 25-6(1931). 2p.

Possible isomerism among various potassium chlororuthenates is discussed. (W.L.H.)

4079 AEC-tr-3109

THE PREPARATION OF METALLIC SCANDIUM IN COMPACT STATE. F. Petru, B. Hájek, and V. Procházka. Translated from Chem. listy 50, 2025(1956). 2p.

Metallic scandium has not yet been prepared in a compact state. In 1937 Fischer and coworkers obtained a preparation by electrolysis of scandium chloride which was sponge-like in appearance, almost grey in color, fragile and hard. Bommer and Hohmann, who used the reduction of scandium chloride by potassium, obtained only a small amount of a mixture of powdered scandium and potassium chloride. In the experiments reported, scandium fluoride or chloride were reduced by calcium for the preparation of metallic scandium. The reaction was performed in a molybdenum crucible heated in an argon atmosphere in a high-frequency induction oven. The reaction, which began at the temperature of 700 to 800°C, was very violent and took place within a short length of time. The metallic scandium was separated by distillation by further heating to 1500°C (under pressure 10^{-4} mm Hg). It was obtained in a compact state, as a silvery, comparatively soft metal which tarnishes in air. Its identity and purity were confirmed by chemical and spectral analysis. (auth)

4080 AEC-tr-3110

PROBLEM OF THE PHYSICOCHEMICAL PROPERTIES OF BORON–CARBON ALLOYS. G. V. Samsonov, N. N. Zhuravlev, and I. G. Amnuel. Translated from Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R., Ural' Filial 3, 309-19(1956). 10p.

An x-ray and microscopic study was made of B–C alloys with C contents ranging from 5 to 72.5% by weight, and their electrical resistance and density were measured. It was found that in B alloys containing 5% C and above, the defective structure of the boron carbide, $B_{13}C_2$, is formed, this being characterized by vacancies along the c-axis of the $B_{13}C_2$ lattice. With 14 to 16% C, the vacancies are filled by C atoms to form the chain –C-B-C-, which is subsequently converted into the chain -C-C-C of the boron carbide $B_{12}C_2(B_4C)$. Alloys with the defective $B_{13}C_2$ lattice possess electronic conductance, depending upon the number of vacancies along the c-axis. (W.L.H.)

4081 AEC-tr-3111

PROGRESS IN THE CHEMISTRY OF SCANDIUM DURING THE LAST TEN YEARS. V. V. Tscherbina. Translated by Elza Zvirbulis from Uspekhi Khim. 9, 1333-(?)(1940). 17p.

4082 AEC-tr-3112

THE THEORY OF INITIAL COMPLEXES IN CHEMICAL KINETICS. II. ENTROPY OF THE ACTIVE STATE. N. I. Kobozev. Translated by Howard G. Neumann from Zhur. Fiz. Khim. 28, 2234-52(1954). 30p.

A new method is suggested for examination of the activated state taking into account its time length and the additional τ-entropy. It has been shown that the theory of the leading complex based on the taking into account of these parameters is able to explain all fundamental cases of chemical kinetics, i.e. "normal," "slow," and "rapid" uni- and bimolecular processes. (auth)

4083 AEC-tr-3113

ON THE FORMATION OF THE LOWER OXIDES OF NIOBIUM AND TANTALUM IN SOME REDUCTION AND OXIDATION REACTIONS. A. V. Lapitsky, Yu. P. Simanov, and E. P. Artamonova. Translated from Zhur. Neorg. Khim. 2, 80-91(1957). 19p.

Processes for the oxidation of metallic Nb and Ta at elevated temperatures were investigated, and also some reactions for the reduction of Nb_2O_5 and Ta_2O_5. Depending on the molar ratios of the starting substances, it was found that at 1100° in an Ar atmosphere the reduction of Nb_2O_5 with metallic Nb can proceed to NbO and NbO_2. It was observed that the reduction of Ta_2O_5 with metallic Ta at 1100° proceeds only in the presence of H_2. Only TaO is obtained as a reduction product. Tantalum pentoxide is not reduced by Al at 1100°. The reduction of Nb_2O_5 and Ta_2O_5 with metallic Mg in vacuo proceeds to the formation of the metal and the lower oxides (NbO, TaO, NbO_2, TaO_2). The secondary reaction products are MgO and either magnesium metaniobate or metatantalate. The formation of NbO and TaO occurs in the metallothermal reduction processes. It was confirmed that Nb_2O_5 and Ta_2O_5 are reduced by CaH_2 to the metals. The secondary reaction products are niobium hydride and tantalum hydride. Niobium and tantalum pentoxides are reduced by CO to the corresponding monoxides. The reduction of Ta_2O_5 with C in a H atmosphere at 1100° proceeds to the formation of the monoxide. It was found that the heating of Nb_2O_5 with C at 1200° in vacuo is not accompanied by the formation of niobium carbide. On the basis of comparing the heats of formation and the heats of decomposition of the oxides and carbides of Nb and Ta, it was concluded that it is impossible to form the carbides under the experimental conditions used. It was established that at 1100° metallic Nb and Ta are oxidized by CO_2 to their higher oxides. Carbon monoxide oxidizes Nb and Ta at the same temperature to their monoxides. (auth)

4084 AEC-tr-3114

THE THEORY OF INITIAL COMPLEXES IN CHEMICAL KINETICS. [PART] I. AN INTERPRETATION OF MODERN THEORIES OF CHEMICAL KINETICS. N. I. Kobozev. Translated from Zhur. Fiz. Khim. 28, 2067-80(1954). 25p.

An analysis of the Eyring-Polanyi theory of the activated complex and the Henshelwood-Kassel theory of the plurality of degrees of freedom is given. It is shown that these theories are unable to explain the high pre-exponential factors, i.e., high entropies of activation in unimolecular processes, and that these entropies cannot be obtained on the basis of interpretation of active complexes as ordinary molecules. (auth)

4085 NP-tr-7

ON THE RELATION BETWEEN THE VISCOSITY AND MOLECULAR STRUCTURE OF LIQUIDS. A. Z. Golik, D. N. Karlikov, and T. G. Shevchenko. Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 114, 361-4(1957). 4p.

4086

ZIRCONIUM NOW SWEEPS INTO THE BIG TIME. T. Peter Forbath. Chem. Eng. 65, No. 1, 128-31(1958) Jan.

New companies and plants for the production of Hf-free Zr are presented. A process flow sheet is also included. (W.L.H.)

4087

COUNTERION BINDING BY POLYELECTROLYTES. I. EXPLORATORY ELECTROPHORESIS, SOLUBILITY AND VISCOSITY STUDIES OF THE INTERACTION BETWEEN POLYPHOSPHATES AND SEVERAL UNIVALENT CATIONS. Ulrich P. Strauss, Daniel Woodside, and Philip Wineman (Rutgers Univ., New Brunswick, N. J.). J. Phys. Chem. 61, 1353-6(1957).

The nature of the binding of lithium, sodium, potassium, and tetramethylammonium ions by polyphosphates, ranging in degree of polymerization from 160 to 27,000 was explored by electrophoresis, salting-out and viscosity studies. With tetramethylammonium bromide as the supporting electrolyte, the electrophoretic mobility is large and changes only little with increasing ionic strength, indicating the absence of site-binding. However, both the magnitude and relative order of the mobility and intrinsic viscosity values obtained in the presence of lithium, sodium and potassium salts suggest site-binding of these cations. The polyphosphates can be precipitated by lithium, sodium and potassium bromide, but not by tetramethylammonium salts. Several observations concerning the precipitation behavior with potassium ion lead to the suspicion that the precipitated potassium polyphosphate is semi-crystalline; the sodium and lithium polyphosphates separate as gels. The large difference in the lithium and sodium concentrations necessary to cause phase separation is explained by the hypothesis that the degrees of solvent incompatibility of the site-bound $LiPO_3$ and $NaPO_3$ groups are different. This hypothesis is also supported by the intrinsic viscosity results. (auth)

4088

THE PROPERTIES OF MgO POWDERS PREPARED BY THE DECOMPOSITION OF $Mg(OH)_2$. D. T. Livey, B. M. Wanklyn, M. Hewitt, and P. Murray (U.K.A.E.A., Harwell). Trans. Brit. Ceram. Soc. 56, 217-36(1957) May.

Magnesia powders, prepared by the decomposition of $Mg(OH)_2$ at various temperatures, both in air and in vacuo, have been examined by measurements of density, surface area, and heat of solution and the particles examined by electron micrographs. Oxide prepared by low-temperature decomposition is active, having a high surface area and a high heat of solution, both of which decrease with increase in temperature of calcination. Powders prepared in vacuo are more "active" than those prepared in air, having a greater surface area and greater heat of solution for a given temperature of preparation. The properties of active powders are considered in relation to general sintering phenomena and the sinterability of these powders is illustrated. (auth)

Analytical Procedures

4089 NP-6533

Australia. Commonwealth Scientific and Industrial Research Organization. Tracer Elements Investigations, Carlton, Victoria.

COUNTING OF RADIO-ACTIVE SAMPLES IN SOLUTION. Tracer Elements Report No. 3. T. H. Oddie. Sept. 1953. 11p.

4090 NP-6537

Australia. Commonwealth Scientific and Industrial Research Organization. Tracer Elements Investigations, Carlton, Victoria.

ANNULAR CASTLE FOR GAMMA-RAY COMPARISON OF POWDERED RADIO-ACTIVE SAMPLES. Tracer Elements Report No. 2. T. H. Oddie. Nov. 1951. 13p.

4091 Y-962(Del.)

Carbide and Carbon Chemical Co. Y-12 Plant, Oak Ridge, Tenn.

ANALYSIS OF LITHIUM METAL, HYDRIDE, AND HYDROXIDE. III. COLORIMETRIC DETERMINATION OF SILICON. H. A. Friedman. Nov. 15, 1952. Decl. with deletions Dec. 4, 1957. 11p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A simple method for the determination of Si chemically to check spectrographic analyses was developed from the well known ammonium molybdate procedure. A straight line calibration curve with maximum sensitivity was obtained up to 100 μg Si in 1M Li solutions if the sample was acidified with 4 or 5 drops of HCl in excess of neutralization prior to the addition of the ammonium molybdate reagent. Results of statistical evaluations show a maximum limit of error of ±1.9% in a 1M Li solution containing 40 μg Si. However, instrumental limitations suggest that actual precision may be less than that indicated statistically. (auth)

4092 Y-973(Del.)

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

ANALYSIS OF LITHIUM METAL, HYDRIDE, AND HYDROXIDE. I. COLORIMETRIC DETERMINATION OF NICKEL. H. A. Friedman. Nov. 15, 1952. Decl. with deletions Dec. 4, 1957. 13p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Nickel may be determined in impure solutions from Li metal, hydroxide, and hydride in the range of 0 to 10 μg by extraction of the nickeldimethylglyoxime complex into chloroform at a pH of 8.5 to 9.0, re-extraction from the chloroform with 1:25 HCl, regeneration of the dimethylglyoxime complex in ammoniacal solution after oxidation of the Ni with Br, and photometric measurement of the color intensity at 450 mμ. Since Li itself does not seem to interfere, Ni in pure solutions may be determined directly without extraction unless concentration is desired. The interference of Cu in the direct procedure was found to be small. However, if Cu is to be determined, the extraction procedure is employed, and any Cu which is in the chloroform is recovered by shaking with dilute ammonium hydroxide. Other interferences in the direct procedure are summarized. Statistical analysis of 1M LiOH containing 8 μg of Ni determined directly indicates a limit of error of ±3.8%, and a bias of −4.1%. (auth)

4093 NP-tr-16

THE APPLICATIONS OF ELECTROPHORESIS ON PAPER TO THE ANALYSIS OF MILK. I. THE ELECTROPHORETICAL PATTERN OF MILK OF MAMMALIAN DOMESTIC ANIMALS IN RELATION TO THE SPECIES TO WHICH THEY BELONG. II. THE ELECTROPHORETICAL PATTERN OF BOVINE MILK TREATED WITH HEAT. Attilio Bosticco and Antonio Ubertalle. Translated from Atti soc. ital. sci. vet. 8, 326-32(1954). 5p.

4094

THE EXTRACTION AND ABSORPTIOMETRIC DETERMINATION OF URANIUM AS THIOCYANATE. J. Clinch and Margaret J. Guy (Analytical Labs., Thorium Ltd., Upphall Road, Ilford, Essex). Analyst 82, 800-7(1957) Dec.

A method is proposed for the determination of U in the presence of many other elements. The U is extracted as thiocyanate from a solution containing ethylenediaminetetraacetic acid at a pH of 3.5 to 3.9 into 32.5% v/v tributyl phosphate in Cl_4. The optical density of the dried organic extract is compared with that of extracts containing no U at 350 mμ in a spectrophotometer. The method has a coefficient of variation of about 0.6%. Application of the method to the determination of U in low-grade ores and to the determination of U in ThO_2 are given. (auth)

4095

THE DETERMINATION OF THORIUM IN ORES WITH APANS-meso TARTARIC ACID REAGENT AFTER A SHORTENED CHROMATOGRAPHIC SEPARATION. D. A. Everest and J. V. Martin (Chemical Research Lab.,

Teddington, Middlesex). Analyst 82, 807-11(1957) Dec.

A rapid procedure is described for the determination of Th in medium-grade and low-grade ores containing as much as 50% of ZrO_2. Thorium is separated from gross amounts of other elements by elution on a cellulose–alumina column and determined by a selective absorptiometric finish with APANS [1-(o-arsonophenylazo)-2-naphthol-3:6-disulphonic acid], mesotartaric acid being used as a masking agent for Zr. (auth)

4096

SURFACE IONIZATION OF SILVER: SILVER IN METEORITES. David C. Hess (Argonne National Lab., Lemont, Ill.) and Royal R. Marshall and Harold C. Urey (Univ. of Chicago, Ill.). Science 126, 1291-3(1957) Dec. 20.

Deuterium and Deuterium Compounds

4097 TT-701

ISOTOPE EXCHANGE OF HYDROGEN IN FREE ALKYL RADICALS. (Izotopnyi Obmen Vodoroda v Svobodnykn Alkil'nykh Radicalakh). G. K. Lavrovskaya (Lavrovskaia), R. E. Mardaleishvili, and V. V. Voevodskii. Translated by G. Belkov from Voprosy Khim. Kinetiki, Kataliza i Reaktsionnoi Sposobnosti Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 40-53(1955). 26p.

It is shown experimentally that there is a new class of radical reactions. These are exchange reactions of radicals with D_2 during which there is no change in the chemical character of the reacting particles and these reactions proceed at very high rates and very low activation energies. On the basis of these results a new method is suggested for identifying the structure of radicals taking part in the mechanism of complex conversions of hydrocarbons. The use of this method does not lead to any essential violation of the process. Thus it was possible to prove experimentally the existence of isomerization (i.e., the transfer of free valency) of free radicals which play a very important role in the mechanism of a number of complex conversions. (auth)

4098

THE INFLUENCE OF THE STRUCTURE OF LIQUIDS ON NUCLEAR RELAXATION BY TRANSLATION. Joseph Seiden. Compt. rend. 245, 1614-17(1957) Nov. 4. (In French)

4099

DENSIMETRIC METHODS FOR ISOTOPIC ANALYSIS OF DEUTERIUM. B. Brigoli. Energia nucleare (Milan) 6, 483-91(1957) Dec. (In Italian)

The most widely used methods for the determination of the deuterium content in water samples are those methods based upon the variation of the density of the water with its deuterium content. Some of the most interesting densimetric methods are here briefly described. (auth)

4100

THE CATALYSIS OF THE H_2-D_2O EXCHANGE BY AQUEOUS BUFFER SOLUTIONS. S. L. Miller and D. Rittenberg (Columbia Univ., New York). J. Am. Chem. Soc. 80, 64-5 (1958) Jan.

The exchange between molecular hydrogen and D_2O is known to be catalyzed by hydroxide ion and follows the rate law[3] $d(P_{HD})/dt = k(P_{H_2})(OH^-)$. The exchange has been investigated at lower pH values in the temperature range 110 to 190° using borate, phosphate, glycine, succinate and acetate buffers. The same rate law is obeyed provided the OH^- concentration measured at 25° is corrected for the change in the pK of the acid and the pK of the water at the higher temperatures. The heat of activation is 28 ± 3 kcal. Neither dilute nor concentrated acids catalyze the exchange. (auth)

Fluorine and Fluorine Compounds

Refer also to abstracts 4580 and 4581.

4101 WADC-TR-56-590(Pt. I)

Colorado. Univ., Boulder.

PHOTOCHEMICAL SYNTHESIS OF ORGANIC FLUORINE COMPOUNDS. Period covered: November 15, 1955 to November 14, 1956. Joseph D. Park and John R. Lacher. Oct. 31, 1956. 102p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3266. (AD-142171).

The purpose of this research work has been to synthesize organic and organo-metallic fluorine compounds with the major objective of obtaining monomers suitable for polymerization into elastomers, plastics, fluids and related material of high thermal and chemical stability. In conjunction with these aims, this Laboratory has synthesized two halogenated pentadienes. Several important four-membered fluorinated ring compounds have been synthesized and their cyclic ethers. To furnish adequate proof of structure and determine the position of unsaturation, the compounds have been halogenated. In the work on alcohols both 1,2-difluoro-2-chloroallyl alcohol and 1,1-difluoro-2-bromoallyl alcohol have been synthesized, the first reported synthesis of a fluorinated allyl alcohol obtainable directly from a Grignard reagent. However, synthesis of trifluoroallyl alcohol has not been achieved. Attempts which have been made to synthesize monohydric and polyhydric alcohols indicate that the proposed routes are feasible. A variety of methods have been used in attempts to prepare alpha, beta-unsaturated ketones (Grignard, free-radical, preparation of alkyl lithium derivatives, Friedel-Crafts-type reactions, and preparation of an unsaturated acid) without success. Several of the ketones derived from the addition of a Grignard reagent to Kel-F Acids have been prepared. As intermediates to the preparation of ketones, two alkynes have been made. (auth)

Graphite

4102 LA-2146

Los Alamos Scientific Lab., N. Mex.

THE FRICTION COEFFICIENTS OF GRAPHITE AT EXTREME TEMPERATURES. Paul Wagner and Allen R. Driesner. Apr. 1, 1957. 20p. Contract W-7405-eng-36. $0.75(OTS).

Measurements were made of the coefficients of friction for graphite and some graphite-base materials which are of interest for nuclear reactor application. Static and kinetic friction coefficients were measured as a function of surface conditioning and temperature up to a maximum temperature of 2450°C. In addition, the effects of force, stress, anisotropy, refractory coating, and U loading were studied. The most significant effect was found to be due to the conditioning of the contact surfaces by polishing action, and this was more pronounced in the static than in the kinetic friction coefficient. The static friction coefficient increased with temperature. Other effects studied had negligible influence. (auth)

Laboratories and Equipment

Refer also to abstracts 4579, 4583, 4587, 4602, and 4605.

4103

RADIOCHEMICAL LABORATORIES. R. Gwozdz (Inst. of Nuclear Research, Warsaw). Nukleonika 2, 507-23(1957). (In Polish)

The danger of exposure to ionizing radiation during the work is discussed, and radiochemical laboratories are classified according to their level of radiation. A concise description of tracer and low-activity laboratories is included. Problems of radioactive contamination in radiochemical laboratories are analyzed. (tr-auth)

Radiation Chemistry

4104

OXIDATION OF FERROUS IONS IN ACID SOLUTION BY POLONIUM ALPHA RADIATION. Marc Lefort. Compt. rend. 245, 1623-6(1957) Nov. 4. (In French)

The alpha rays of Po oxidize Fe^{2+} ions in aqueous H_2SO_4 solution with a yield, G, of 5.6 ± 0.1 in air and 3.65 ± 0.1 without air. For 2×10^{-5} molar, the yield is lowered to 0.95 in absence of air for high intensities. One deduces from these results the yields for radicals combined H_2O_2 [$G_p(H_2O_2) = 1.35$] and for the remaining free OH radicals [$G(OH) = 0.95$]. (tr-auth)

4105

PRACTICAL HANDBOOK IN RADIOCHEMISTRY. An. N. Nesmeyanov, V. I. Baranov, K. B. Zaborenko, N. P. Rudenko, and Yu. A. Priselkov. State Publishers of Scientific and Technical Literature. Moscow, 1956. 398p. (In Russian)

The handbook is divided into chapters covering the techniques of measurements of radiation, investigation of radioactive transformations, production of radioactive isotopes, and their application as labeled atoms. Each chapter carries a short theoretical introduction to the practical experiments. A special chapter is devoted to descriptions of the equipment for radiochemical laboratories and personnel protection techniques. The handbook is planned for the use of personnel working in radiochemical laboratories using radioisotopes. (R.V.J.)

Radiation Effects

Refer also to abstract 4160.

4106 CF-57-12-125

Oak Ridge National Lab., Tenn.

THIRD QUARTERLY LETTER PROGRESS REPORT FOR DELIVERY ORDER NO. 33(616)-57-17. J. C. Pigg. Dec. 23, 1957. 34p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Results are described of the initial investigation undertaken on the effects of neutron and gamma radiation on chemically deposited, thin films of lead sulfide. These films are highly sensitive to infrared radiation and have a wide variety of commercial and military applications. The irradiation effects manifest themselves by the changes brought about in the electrical and photoconducting properties of this semiconductor which are a result of additional crystalline imperfections. The results of this investigation are intended primarily to be of practical interest, since the polycrystalline structure of these films, as well as the relatively high and localized concentration of other impurities, makes a fundamental understanding of their behavior very complex. This paper presents results obtained thus far. (auth)

4107 K-1027

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

EFFECTS OF ALPHA PARTICLES ON CHLORINE TRIFLUORIDE GAS. W. S. Wendolkowski and W. Davis, Jr. July 15, 1953. Decl. Oct. 29, 1957. 20p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Limited investigations were made of the rate of decomposition of gaseous ClF_3 under α-particle irradiation at room temperature. ClF_3 decomposes primarily to ClF and F_2; the calculated decomposition yield is less than one molecule per ion pair. Approximate curves of ionization of ClF_3 by the several α-particles emitted during the decay of Rn have been constructed. (auth)

4108 NYO-7624

Brown Univ., Providence.

RADIATION DAMAGE STUDIES IN SOLIDS; NUCLEAR RESONANCE ABSORPTION TECHNIQUE. Period covered: January 1, 1957 through August 31, 1957. P. J. Bray. Sept. 1, 1957. Includes three abstracts: B^{11} NUCLEAR MAGNETIC RESONANCE IN PLANAR HEXAGONAL COMPOUNDS. A. H. Silver and P. J. Bray; NUCLEAR MAGNETIC RESONANCE IN PILE-IRRADIATED LiI. John F. Hon and P. J. Bray; and NUCLEAR QUADRUPOLE COUPLING CONSTANTS OF Li^7 IN LITHIUM COMPOUNDS. P. J. Bray and J[ohn] F. Hon. 30p. Contract AT(30-1)-1880. $4.80(ph OTS); $2.70(mf OTS).

Radiation damage effects have been observed and measured in NaI, KI, LI, and KBr which have received reactor irradiation. The data have been used to determine the defect density in the irradiated crystals and the mean free path between displacement collisions. The results are in substantial agreement with the calculations of Seitz and Koehler. Pre-irradiation studies of boron carbide have shown that the central "carbon" position in the "three-carbon chain" of this structure is often occupied by a boron atom. Pre-irradiation studies of boron oxide-alkali oxide glasses have uniquely determined the boron-oxygen configuration and bonding behavior as a function of the glass composition. The results offer an explanation of the thermal expansion and volume per oxygen dependence on the oxygen content of the glass. The bonding electron distributions in several metal borides and boron nitride have been determined from the effect of the B^{11} electrical quadrupole coupling constant on the nuclear magnetic resonance. (See also NYO-7623.) (auth)

4109 RIA-57-1002

Rock Island Arsenal Lab., Ill.

GAMMA RADIATION OF ELASTOMERS AND THEIR MONOMERS. Z. T. Ossefort. Apr. 18, 1957. 32p. (AD-133128).

Paper for presentation at Army Conference on Elastomers, April 24 and 25, 1957, Ft. Belvoir, Va.

A very brief history of the research conducted relating to the effects of high-energy radiation on polymers and the position of Ordnance regarding high energy radiation and its effects on materials are presented. The types and sources of high energy radiation available, the basis for selecting gamma radiation as the study tool at Rock Island Arsenal, and the mechanism whereby high energy radiation affects the properties of materials are discussed. A description of the RIA gamma source and procedure for use are given along with a listing of the major areas of investi-

gation in the field of elastomers. Specific examples and data typifying the work being performed in the following four areas of elastomer research are presented: effects of radiation on vulcanized elastomers; the properties of elastomers which have been cured by exposure to varying dosages of gamma radiation; evaluation of potential antirads in nitrile rubber; and gamma radiation initiated polymerization and grafting. (auth)

4110 WADC-TR-57-465
Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF HIGH-ENERGY, HIGH-INTENSITY ELECTROMAGNETIC RADIATION ON ORGANIC LIQUIDS. [Period covered] May 1956 to April 1957. E. M. Kinderman. Sept. 30, 1957. 55p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: EFFECTS OF NUCLEAR RADIATION. Contract AF33 (616)-3738.

WADC-TR-57-141, "A Comparison of High-Energy Electron and Gamma Irradiation Effects on Organic Liquids," was issued June 26, 1957.

A series of organic esters, hydrocarbons, and miscellaneous compounds were subjected to radiation. A quantitative measurement of the amounts and kinds of radiation products produced was made. From the observed products and their amounts, some inferences were made as to the stability of these materials and the influence that their structure had on their stability. Radiolysis of organic liquids is influenced by structure. Molecules containing branch chain and benzyl groupings are more susceptible to radiolytic damage than are molecules containing only straight chain groupings. This greater damage may be explainable in terms of the greater inductive effects possible with the branch chain and benzyl groupings. Greater radiation stability is observed with higher molecular weight compounds. This effect may be explained in terms of the mechanisms of energy absorption and disintegration by the molecule. Comparison of the radiolytic with mass spectrographic data shows some correlation between the modes of molecular disintegration induced in the two cases. The correlation is best when conditions of radiolysis are similar to those in the mass spectrograph, that is when radiolysis occurs in an essentially low pressure condition through activated species whose half-life is short and whose diffusion constants or reaction times are long. Both electron and gamma radiation was used. The former received emphasis because of its speed and convenience in the test program. Comparison of the effects of the two types of radiation in six cases shows some quantitative differences in radiolytic yield. The products identified are the same, and the same structural effects are evident. The available data do not permit definite statements of equivalence between electron and gamma effects, although this is indicated. (auth)

4111 NP-tr-5
STIMULATION OF BRANCHED CHAIN REACTIONS BY THE ACTION OF PENETRATING RADIATIONS IN THE INITIAL PERIOD OF THE DEVELOPMENT OF THE PROCESS. N. M. Emanuel. Translated by P. Collins from Doklady Akad. Nauk S.S.S.R. 111, 1286-9(1956). 7p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstract, Vol. 11 as abstract No. 5812.

4112
THE EFFECT OF HIGH ENERGY GAMMA RAYS ON SYNTHETIC MATERIAL. A. Matting. Atomkern Energie 2, 486-90(1957) Nov.-Dec. (In German)

4113
EFFECTS OF GAMMA RADIATION ON THE CONDUCTIVITY OF PETROLEUM ETHER. M. R. Gibaud. J. phys. radium 18, 60S-2S(1957) Nov. (In French)

Rare Earths and Rare-earth Compounds

4114
INTERPRETATION OF VARIATIONS IN THE FERROMAGNETIC RESONANCE FIELD OF GADOLINIUM GARNET WITH TEMPERATURE. Jean Pauleve. Compt. rend. 245, 1604-7(1957) Nov. 4. (In French)

4115
CERTAIN RARE EARTH ARSENATES WITH ZIRCON STRUCTURE. Andre Durif and Francis Forrat. Compt. rend. 245, 1636-8(1957) Nov. 4. (In French)

Five rare earth arsenates, isomorphs of zircon, are described to specify the region of existence of rare earth arsenates with zircon structure. This region is more limited than in the case of the vanadates. A new determination of the lattice of yttrium arsenate is given. (tr-auth)

4116
EFFECTS OF A CUBIC ELECTRIC FIELD ON THE FUNDAMENTAL LEVELS OF THE Gd^{3+} ION. R. Lacroix. Helv. Phys. Acta 30, 478-80(1957). (In French)

4117
THE PREPARATION, LATTICE PARAMETERS AND SOME CHEMICAL PROPERTIES OF THE RARE EARTH MONOTHIO OXIDES. H. A. Eick (Univ. of Kentucky, Lexington). J. Am. Chem. Soc. 80, 43-4(1958) Jan.

A method of preparation and the unit cell dimensions are given for the mono-thio oxides of lanthanum, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium. The space group is $D_{3d}^3 - P\bar{3}m$, with the atomic positions being two metal atoms in $\pm(1/3, 2/3, u_1)$, $u_1 \approx 0.29$, two oxygen atoms in $\pm(1/3, 2/3, u_2)$, $u_2 \approx 0.64$, and one sulfur atom in (0, 0, 0). Evidence is presented for a new isostructural series of rare earth compounds having the formula $M_2O_2SO_4$. These compounds are very easily reduced to the mono-thio oxides. (auth)

Separation Procedures

Refer also to abstracts 4575, 4576, 4577, 4584, 4585, 4593, 4595, 4597, 4598, 4601, and 4642.

4118 KAPL-1758
Knolls Atomic Power Lab., Schenectady, N. Y.
THE FAST OXIDE BREEDER—RADIATION EFFECTS IN CHEMICAL PROCESSING OF FAST OXIDE BREEDER FUEL. S. S. Jones. June 14, 1957. 38p. Contract W-31-109-eng-52. $1.25(OTS).

Various ways in which KAPL Fast Oxide Breeder fuel processing may be affected by absorption of fission-product radiations are discussed. Results of experimental investigations are presented. While radiation will affect the process significantly, no prohibitive difficulties are known. However, amid the various complexities of such a system, only a mixer-settler run at full radiation level and solute concentrations can give a completely satisfying answer in a reasonable length of time. (auth)

4119 KLX-10089
Vitro Labs., West Orange, N. J.
FISSION PRODUCT SEPARATIONS STUDY. Final Report for the period September 27, 1956—June 30, 1957. R. A. Keeler and C. J. Anderson. Nov. 29, 1957. 47p. Contract W-7405-eng-36. $7.80(ph OTS); $3.30(mf OTS).

The solubility of $SrSO_4$ as a function of temperature and

HNO_3 concentration was studied to evaluate this property as a means of separating Sr from radioactive waste. Coprecipitating tests at low and high temperatures were conducted to determine the effectiveness of Ca, Ba, and Pb in scavenging Sr from acid solutions. Several silicate and phosphate minerals were evaluated for their ability to remove Cs and Sr from fission product waste solution. The possibility of extracting slightly soluble cesium picrates from HNO_3 solution by butyl alcohol was investigated with studies of Cs distribution vs. HNO_3 concentration. (See also KLX-10078.) (T.R.H.)

4120 ORNL-2388
Oak Ridge National Lab., Tenn.
PROGRESS REPORT ON RAW MATERIALS FOR JULY 1957. Chemical Technology Div. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. Jan. 9, 1958. 25p. Contract W-7405-eng-26. $0.75(OTS).

Systematic Studies. Three new amine samples, tris(tridecyl)-, N-(1-undecyldodecyl)dodecyl-, and N-(1-nonyldecyl)-dodecylamine, showed good uranium extraction performance and low losses to aqueous liquors. Tests with a new batch of trilaurylamine continued to show the potential utility of this reagent. The purity of the new sample was lower than for previous batches, however, and the phase separations during extraction were slower. Tests with tri(n-octyl)phosphine oxide and 2-phenylvinyl(dioctyl)-phosphine oxide showed the latter to be the poorer extractant. In further tests of synergistic reagent systems for uranium extraction, diamyl amylphosphonate (DAAP) was shown to be a promising reagent for process use. The compound is potentially available in commercial quantities at a price lower than that of dihexyl hexylphosphonate (DHHP). Uranium extraction performance and losses to aqueous liquors are similar to those for DHHP. Process Development. The coefficients for extraction of uranium with tri-n-octylamine in kerosene–alcohol diluent were approximately equivalent with capryl alcohol, mixed decanols, or tridecanol in concentrations of 0.04 to 0.20 M alcohol. The coefficients decreased markedly when the alcohol concentration was increased to 0.3 and 0.5 M. With 0.10 M nonylphenol or 0.04 dinonylphenol added to the solvent, coefficients were similar in magnitude to those obtained with 0.04 to 0.20 M alcohol modifier. Addition of nonylphenol or dinonylphenol in concentrations as high as 0.2 M, however, severely depressed uranium extraction. The effect of small concentrations of chloride and nitrate on thorium recovery by the Amex process from uranium-barren Blind River liquors was evaluated. The chloride or nitrate enters the liquor during ion-exchange recovery of uranium. The presence of chloride depressed thorium extraction but not sufficiently to interfere seriously with process performance. Nitrate interference, on the other hand, was severe, indicating that special provisions would be necessary for treating uranium-barren raffinates where nitrate elution is used in the ion-exchange process. Nitrate was extracted effectively, suggesting the possibility of nitrate recovery from the liquor prior to thorium extraction. In addition, a process for simultaneous recovery of thorium and nitrate by the Amex process appears economically attractive and is being given further study. Engineering Studies. The rate of uranium extraction from two synthetic sulfuric acid leach liquors by the Dapex solvent was proportional to the cube root of power input in mixers of three different sizes. The rate was nearly independent of the particular combinations of uranium concentration, phase ratio, and solvent strength. Scale-up of mixers by constant power input per unit mixer volume was demonstrated to be slightly conservative for 6-, 12-, and 20-in. baffled tank mixers which are geometrically similar. (auth)

4121 TID-5189
Ames Lab., Ames, Iowa.
HIGH TEMPERATURE FUEL PROCESSING CONFERENCE HELD AT AMES LABORATORY, NOVEMBER 10-11, 1953. Oct. 6, 1954. Decl. Mar. 4, 1957. 44p. Contract W-7405-eng-82. $1.25(OTS).

A survey on high-temperature fuel processing was presented by representatives of laboratories actively engaged in research on this program. Studies reported include volatilization of Pu and fission products, scavenging, liquid salt extrusion, electrolytic refining, C slagging coupled with UCl_3 extraction, fluorine extraction, and liquid metal extraction. (C.H.)

4122 WIN-56
National Lead Co., Inc. Raw Material Development Lab., Winchester, Mass.
AMENABILITY TESTING OF AMBROSIA LAKE DISTRICT ORE. H. E. Dixon and H. I. Viklund. Jan. 2, 1958. 62p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

The results of acid and alkaline amenability tests on 28 samples from the Ambrosia Lake District of New Mexico are presented. (auth)

4123 WIN-79
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
ALKALINE LEACH–FILTRATION PILOT PLANT TESTING OF GLOBE MINING COMPANY ORE. G. R. Pitmon and Guy Winslow. Oct. 18, 1957. 38p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

During the period of May 17 to June 22, 1957, Globe Mining Company ore from the Gas Hills district of Wyoming was treated in the Alkaline Leach–Filtration Pilot Plant at Grand Junction, Colorado. The report contains detailed information on grinding, leaching, filtration, and precipitation in connection with the processing of this ore. Pachuca leaching was employed, and results show the ore to be amenable to the Alkaline Leach–Filtration process. (auth)

4124 NP-tr-22
RECTIFICATION OF LOW CONCENTRATION BINARY MIXTURES. K. Pohl. Translated by W. A. Olscher from Chem.-Ing.-Tech. 28, 562-4(1956). 10p.

A numerical process is given for calculating reflux ratio, theoretical plates, and plate concentrations vs. temperature in distillation of binary mixtures with a concentration so low that the equilibrium curve is a straight line. (T.R.H.)

4125 NP-tr-25
BEHAVIOUR OF CHARGED POROUS MEMBRANES DURING THE PASSAGE OF CURRENT. (Uber das Verhalten geladener Porenmembranen bei Stromdurchgang.) R. Schlögl and H. Schödel. Translated from Z. physik. Chem. (Frankfurt) 5, 372-97(1955). 23p.

4126
THE DEPOSITION OF METALS OTHER THAN THOSE OF THE TITANIUM GROUP BY THE HOT FILAMENT TECHNIQUE. R. A. J. Shelton (Univ. of Manchester). Metallurgia 56, 283-9(1957) Dec.

The deposition of metals by the hot filament technique may be carried out by either the flow method or the sealed-tube method. The former requires the vapor of a volatile compound of the metal to be passed over an electrically heated filament, either by entrainment with hydrogen or by the use of a pump, while the latter requires the continuous formation and decomposition of the volatile compound within the sealed apparatus. The essential difference between the two uses of the technique lies in the mode of removal of the gaseous product of the filament reaction. In the flow method it is pumped away or swept

from the reaction site, and in the sealed bulb method it is removed by its reaction with the metal in the apparatus. Faster rates of deposition may be obtained with the flow method, but on account of its susceptibility to contamination by the atmosphere, the sealed bulb method is preferred where oxygen and nitrogen, even in very small concentration, can not be tolerated. (A.C.)

Sorption Phenomena

4127

HEATS OF ADSORPTION ON EVAPORATED NICKEL FILMS. D. F. Klemperer and F. S. Stone (Univ. of Bristol, Eng.). Proc. Royal Soc. (London), A243, 375-99(1958) Jan. 14.

The adsorption of oxygen, hydrogen, and carbon monoxide has been studied on evaporated films of nickel prepared under varied conditions with a view to defining more precisely the differences in behavior between nickel films and nickel powder. Heats of adsorption on the films have been determined at room temperature using a resistance-thermometer calorimeter. The extent of the adsorption with oxygen and hydrogen has been assessed by means of krypton isotherms at 77°K, and by means of established correlations between activity and weight for equivalent films. The coverage with oxygen reaches a complete monolayer, but with hydrogen at 0.1 mm pressure, the coverage is estimated at 40%. Curves of differential heat versus coverage have been approximated by making heat measurements for small increments. With oxygen, a study over 15 increments shows a heat of adsorption which is constant near 150 kcal/mole for 80% of the uptake, but which falls ultimately to a value well below 50 kcal/mole. With hydrogen, there is a continuous, almost linear fall with coverage from an initial heat near 40 kcal/mole to a final heat near 10 kcal/mole. The reversibility of the hydrogen adsorption has been specifically examined. The films as originally prepared are porous with surface areas of 30 m^2/g or higher, but the act of chemisorption appears to initiate sintering. The integral heats with each gas studied are, without exception, greater than those reported for nickel powders. From the collated results, it is suggested that the enhancement of the heat is related to the degree of disorder of the metal specimen, and attention is drawn to the possibility of release of stored energy from films on rapid chemisorption of gases. Heats of adsorption have also been measured on "oxided" films obtained by heat treatment in vacuo of oxygenated surfaces. It is apparent that the behavior of the nickel films approaches that of powders at high coverages of chemisorbed gases, or, equally, after sintering. (auth)

4128

THE HEATS OF ADSORPTION OF THE INERT GASES ON CHARCOAL AT LOW PRESSURE. K. F. Chackett and D. G. Tuck (Univ. of Birmingham and Univ. of Manchester, Eng.). Trans. Faraday Soc. 53, 1652-8(1957) Dec.

The heats of adsorption of neon, argon, krypton, and xenon on charcoal have been measured by a differential method in the pressure range 10^{-2} to 10^{-4} mm. The values found are respectively 1.13, 3.93, 5.32, and 8.74 kcal/g atom. These values are discussed in relation to the surface coverage of the adsorbent, to some of the physical properties of the inert gases, and to the published values for the heats of adsorption of helium and radon. (auth)

Spectroscopy

4129

INFRARED SPECTRAL STUDIES OF HYDROGEN BONDING PHENOMENA IN SOLUTIONS CONTAINING HYDROGEN FLUORIDE. Richard M. Adams and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). J. Mol. Spectroscopy 1, 306-32(1957) Dec.

An infrared spectral study of hydrogen bonding phenomena has been carried out on solutions of anhydrous HF (and in some cases DF) in the following solvents: diethyl ether, tetrahydrofuran, dioxane, ethanol, ethanol-d, trifluoroethanol, acetone, acetonitrile, diethyl sulfide, phenol, nitrobenzene. In general three new broad regions of absorption appear centering around (a) 3000 cm^{-1} (b) 1800 cm^{-1}, and (c) 800 cm^{-1}, which are attributed respectively to (a) the stretching vibration of HF in a molecular complex, (b) the HF_2^- ion, (c) a hydrogen vibration in a molecular complex, probably the out-of-plane vibration in the X−H−F bond. There are also observed in many of the spectra new, sharp peaks which appear to be disturbances of the peaks due to the functional groups. These are attributed to the formation of molecular complexes. (auth)

Syntheses

4130 NAA-SR-2147

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE SYNTHESIS OF BIPHENYL-4,4′-d_2. R. I. Akawie. Dec. 15, 1957. 12p. Contract AT-11-1-GEN-8. $0.50 (OTS).

The synthesis of biphenyl-4,4′-d_2 from biphenyl by bromination to 4,4′-dibromobiphenyl, exchange with n-butylithium reagent, and hydrolysis with deuterium oxide is described. The over-all yield was 44%. (auth)

Tracer Applications

4131

METABOLISM OF ESSENTIAL FATTY ACIDS. VII. CONVERSION OF γ-LINOLENIC ACID TO ARACHIDONIC ACID. James F. Mead and David R. Howton (Univ. of California, Los Angeles). J. Biol. Chem. 229, 575-82 (1957) Dec.

Methyl γ-linolenate-1-C^{14} was fed to rats, and the fatty acids of depot and organ lipides of the rats were separated chromatographically and counted. The sole highly active fatty acid was arachidonic, which, after hydrogenation and degradation in three steps, was found to have 97% of the activity in carbon atom 3. These results support the hypothesis that γ-linolenic acid is an intermediate in the conversion of linoleic acid to arachidonic acid. (auth)

4132

THE THEORY OF ISOTOPIC METHODS IN THE INVESTIGATION OF CHEMICAL REACTIONS. S. Z. Roginskii. Publishing House of the Academy of Sciences, U.S.S.R. Moscow, 1956. 611p. (In Russian)

Information is included on thermodynamic isotopic effects, kinetics of noncomplicated isotopic exchange, mechanisms and stages of isotopic exchange, isotopic effects in chemical kinetics, kinetics of complex isotopic exchange, and the basic areas of applications and perspectives of development of isotopic methods in chemical kinetics. Tables of thermodynamic functions, isotopic exchange equilibrium constants, and tables developed according to the kinetic isotopic effects of isotopic exchange are included in the appendix. (R.V.J.)

4133

LAMONT NATURAL RADIOCARBON MEASUREMENTS. IV. W. S. Broecker and J. L. Kulp (Columbia Univ., Palisades, N. Y.). Science 126, 1324-34(1957) Dec. 27.

Carbon^{14} age determinations were made by the CO_2 gas

proportional counting method on geologic samples, archeological samples, and samples of sediment from oceans and lakes. Data are tabulated. (C.H.)

Transuranic Elements and Compounds

Refer also to abstracts 4590 and 4591.

4134
INDUSTRIAL PRODUCTION OF Pu AT HANFORD. Atomkern Energie 2, 494-5(1957) Nov.-Dec. (In German)

4135
THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART VI. PLUTONIUM DIOXIDE. J. L. Drummond and G. A. Welch (United Kingdom Atomic Energy Authority, Windscale Works, Cumberland). J. Chem. Soc. 4781-5(1957) Dec.

Several different forms of plutonium dioxide have been prepared. That made by ignition at 1200° is stoichiometric; that prepared by direct ignition of metal at lower temperatures closely approaches stoichiometric; and that prepared by ignition of plutonium salts at 870° in air has a higher molecular weight. We suggest that the dioxide has a formula in the range $PuO_{2.00-2.09}$ depending upon the starting material and ignition temperature. (auth)

4136
THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART VII. PLUTONIUM CARBIDES. J. L. Drummond, B. J. McDonald, Heather M. Ockenden, and G. A. Welch (U. K. Atomic Energy Authority, Windscale Works, Cumberland). J. Chem. Soc. 4785-9 (1957) Dec.

Plutonium monocarbide, PuC, has been prepared by the reaction of graphite with plutonium metal or hydride at about 900°C. A sesquicarbide, Pu_2C_3, was formed, in addition to the monocarbide, by the reduction of plutonium dioxide with graphite at 1800 to 1900°C. Both carbides are reactive and easily hydrolyzed by dilute acid or boiling water. Strong chemical and x-ray evidence suggests that a higher carbide exists but it has not been identified unequivocally. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 4578, 4588, 4592, 4594, 4596, 4599, and 4600.

4137 BMI-1241
Battelle Memorial Inst., Columbus, Ohio.
COMPARISON OF ACTIVE AND INACTIVE URANIUM DIOXIDE–OXYGEN SYSTEMS. Dale A. Vaughan, J. Robert Bridge, and Charles M. Schwartz. Dec. 10, 1957. 18p. Contract W-7405-eng-92. $0.75(OTS).

Inactive UO_2 oxidizes at 180°C by the formation of a tetragonal oxide (U_3O_7), which is unstable, on heating above 300°C. The U_3O_7 in compositions below $UO_{2.25}$ reacts with UO_2 to form UO_{2+x} and U_4O_9. At compositions above $UO_{2.25}$, the tetragonal phase is stable to 600°C. In the homogenized condition, both U_3O_7 and U_4O_9 are n-type conductors, while UO_{2+x} is p-type. The solubility limit of O in UO_2, as determined by x-ray diffraction data and electrical measurements, is $UO_{2.08}$ at 25 and 200°C, $UO_{2.11}$ at 400°C, $UO_{2.17}$ at 600°C, and $UO_{2.20}$ above 700°C. The active UO_2 oxidation product retains the cubic symmetry of UO_2 up to the composition $UO_{2.40}$ and is stable to 600°C in vacuum. The structural behavior of the active oxide in this composition range is significantly different from that of the inactive oxide. (auth)

4138 KAPL-M-EGB-26
Knolls Atomic Power Lab., Schenectady, N. Y.
RESULTS OF NATURAL URANIUM (3.8 wt. %) ZIRCONIUM ALLOY; D1G–CWA CORROSION TESTS. Progress Report No. I. D. C. Belouin, E. G. Brush, and R. E. Campagnoni. Dec. 1957. 20p. Contract [W-31-109-eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

Tests have been conducted in de-ionized water at 200, 400, and 600°F to determine U release through corrosion of 4 wt. % U–Zr alloy, both coupled and uncoupled with 2S aluminum at 200°F, uncoupled only at 400 and 600°F. Results indicate that U release of uncoupled U–Zr up to 1500 and 1000 hours, respectively in water at 200 and 400°F, is about 5×10^{-5} mg/dm^2/hour. At 600°F somewhat more severe corrosion occurs with formation and spallation of characteristic yellow corrosion product (absent at the lower temperatures). Galvanic coupling of U–Zr with 2S aluminum results in increased corrosion of the Al through differential aeration cells rather than by galvanic attack in 200°F water. The results also indicate that, at constant temperature (200°F) the corrosion rate increases with oxygen contamination in the test medium. Furthermore there appears to be a change in corrosion mechanism with temperature so that room temperature corrosion rates obtained by extrapolation may vary approximately by a factor of 10. Further room temperature tests are underway to narrow this spread. (auth)

4139 Y-1176
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
AN IMPROVED METHOD OF MEASURING URANIUM CONCENTRATION IN URANIUM–ALUMINUM ALLOY BY GAMMA COUNTING. P. F. Haughton, C. R. Fultz, and L. E. Burkhart. Mar. 29, 1957. 17p. Contract W-7405-eng-26. $0.75(OTS).

A scintillation counter has previously been used to measure U concentration in U–Al alloy reactor slugs. The present method is an improvement in that the entire slug is now being counted, using a larger crystal and multiplier phototube. The U distribution in the individual slugs is discussed. This, plus improvements in equipment used, gives a somewhat lower limit of error. Data on 105 cast and 75 machined slugs are given and analyzed. Various applications are discussed. (auth)

4140
COPPER SALT CATALYSIS OF THE AIR OXIDATION OF REDUCED URANIUM COMPOUNDS IN CARBONATE–BICARBONATE SOLUTIONS. Warren E. Clifford (Arthur D. Little, Inc., San Francisco, Calif.). J. Am. Chem. Soc. 80, 245(1958) Jan.

It was found that Cu salts, especially in the presence of NH_3, catalyze the air oxidation and dissolution of reduced U compounds in carbonate–bicarbonate solutions in the carbonate leaching of U ores. (W.L.H.)

4141
URANIUM IN SOUTH AFRICA, 1946–1956. VOLUME I AND II. Johannesburg, The Associated Scientific & Technical Societies of South Africa, 1957. Vol. I 557p. Vol. II 488p.

A joint syposium on uranium in South Africa is reported by the associated Scientific and Technical Societies of South Africa. A historical review is given of the events and developments in construction of plants for the recovery of uranium from gold ore residues. The geological background and development of uranium industry of South Africa are described. Methods of chemical determination

of U, the acid leaching process for the extraction and recovery of U from cyanide residues, the ion exchange process of U extraction from Rand ores, flotation U and pyrite, determination of U and Th in uranium–thorianites and monazites by an equilibrium method, and sulfuric acid production are discussed. Co-operative construction of uranium plants, designs, mechanical and electrical maintenance, and joint production of uranium, as well as the raw material requirements for the uranium program, are analyzed, and national aspects of the uranium industry are evaluated. (R.V.J.)

Waste Disposal

4142 AECU-3606
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
RADIOACTIVE WASTE DISPOSAL SYSTEM; SYSTEM DESCRIPTION NO. 24. Charles R. Claxton. Aug. 31, 1956. 250p. $37.80(ph OTS); $11.10(mf OTS).

A radioactive waste disposal system was designed to provide facilities necessary to contain, process, and dispose of radioactive wastes from the Pressurized Water Reactor plant and its auxiliaries in such a manner as not to exceed specified tolerances for discharge of radioactive materials to the environment. Procedures and equipment used in segregating, processing or storing, and ultimate disposal of the radioactive wastes are described in detail. (C.H.)

4143 NP-6503
National Research Council. Committee on Waste Disposal.
THE DISPOSAL OF RADIOACTIVE WASTE ON LAND. Publication No. 519. Sept. 1957. 145p.

A committee of geologists and geophysicists was established by the National Academy of Sciences-National Research Council at the request of the Atomic Energy Commission to consider the possibilities of disposing of high level radioactive wastes in quantity within the continental limits of the United States. The group was charged with assembling the existing geologic information pertinent to disposal, delineating the unanswered problems associated with the disposal schemes proposed, and point out areas of research and development meriting first attention; the committee is to serve as continuing adviser on the geological and geophysical aspects of disposal and the research and development program. Two years' consideration of the disposal problems leads to certain general conclusions. Wastes may be disposed of safely at many sites in the United States but, conversely, there are many large areas in which it is unlikely that disposal sites can be found, for example, the Atlantic Seaboard. The research to ascertain feasibility of disposal has for the most part not yet been done. Disposal in cavities mined in salt beds and salt domes is suggested as the possibility promising the most practical immediate solution of the problem. Disposal could be greatly simplified if the waste could be gotten into solid form of relatively insoluble character. In the future the injection of large volumes of dilute liquid waste into porous rock strata at depths in excess of 5,000 feet may become feasible but means of rendering the waste so solutions compatible with the mineral and fluid components of the rock must first be developed. The main difficulties to the injection method recognized at present are to prevent clogging of pore space as the solutions are pumped into the rock and the prediction or control of the rate and direction of movement. (auth)

ENGINEERING

Refer also to abstracts 4604, 4606, and 4615.

4144 CF-57-10-30
Oak Ridge National Lab., Tenn.
HRP—COMPARISON OF SEVERAL LINE CONNECTORS FOR HIGH PRESSURE AND/OR HIGH TEMPERATURE DISCONNECTS. C. C. Haws, Jr. Oct. 3, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A description is presented, including the advantages as compared to flanged joints, of two couplings which might find application to HRP or other high pressure and/or high temperature uses. From examination and limited experience, both the Graloc and the EGA couplings appear simple, durable, reproducibly leak tight, and easy to install. There does not appear to be any simple modification for either coupling which would permit use of the HRT type of leak detector system. (auth)

4145 CF-57-12-74
Oak Ridge National Lab., Tenn.
ENTRAINMENT IN 5000 gpm GAS SEPARATOR. B. A. Hannaford. Dec. 10, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A large gas separator of the pipe-line type was operated at a water flow rate of 5000 gpm and several gas flow rates to determine the effect of entrainment upon separator efficiency. Efficiency was found to be relatively insensitive to changes in gas flow rate over the range 6.2 to 35.8 actual cfm. and changes in entrainment over the range of 1 to 20 gpm. (auth)

4146 CF-57-12-83
Oak Ridge National Lab., Tenn.
AN ANALYSIS OF THE MATERIALS REQUIREMENTS FOR THE CONSTRUCTION OF A CODE PRESSURE VESSEL. E. A. Franco-Ferreira. Dec. 17, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Design and construction of the GCR pressure vessel may or may not proceed according to the ASME Boiler Code. It is apparent that adherence to the Boiler Code will, at the very least, result in a generation of confidence in the minds of the public. Consequently, an effort has been made to analyze the GCR pressure vessel in terms of the Boiler Code, and to survey the various materials of construction which will be applicable under the Code. This memorandum presents the results of the analysis. (auth)

Heat Transfer and Fluid Flow

4147 AGC-1379
Aerojet-General Corp., Azusa, Calif.
EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID-FLOW SYSTEMS. Final Report. E. L. Geery, L. Green, Jr., and K. L. Nall. Dec. 31, 1957. 57p. Project No. 6-(1-9964). Contract AF33(616)-3767.

The design, progress, and conclusions of experiments on heat removal from an extended-surface heat source, controlled flow-separation in a supersonic exhaust nozzle, and heat transfer to a flow of cryogenic fluid in the vicinity of its critical temperature are reviewed. The results of the heat-removal and flow-separation studies indicate that porous construction can permit the efficient gas cooling of a source of high specific power, and that controlled flow-separation at optimum area ratio can be promoted by

means of boundary injection. The cryogenic-fluid heat-transfer experiment progressed to the point of construction and preliminary checkout of the apparatus, but no systematic experiments could be performed. The experimental details are described. The newly-constructed Heat-Transfer Laboratory used in the program is described in the appendix. (auth)

4148 AGC-1380
Aerojet-General Corp., Azusa, Calif.
HEAT REMOVAL FROM A RESISTANCE-HEATED POROUS SOLID. L. Green, Jr., and K. L. Nall. Dec. 31, 1957. 72p. Project No. 6-(1-9964). Contract AF33(616)-3767.

The design and preliminary results of an experimental investigation of the gas cooling of a resistance-heated, porous-graphite, heat source are described. On the basis of a review of previous investigations of heat transfer in porous media, a steady-state experiment was designed to permit the derivation of gas-solid heat-transfer coefficients (using the results of an analysis that is outlined in the appendix) without requiring highly precise measurements of the gas temperature at the entrance and exit faces of the porous specimen. Owing to contact-resistance effects, the heat-transfer data obtained are regarded as tentative, subject to confirmation in measurements using a refined heating technique. The heat-transfer data were obtained at a specific power density of 2.2 Mw/ft^3; exploratory tests indicated, however, once the contact-resistance effects are avoided, efficient heat removal at power densities of the order of 100 Mw/ft^3 may be demonstrated. (auth)

4149 AGC-1381
Aerojet-General Corp., Azusa, Calif.
CONTROL OF FLOW SEPARATION IN SUPERSONIC NOZZLES BY MEANS OF BOUNDARY-LAYER INJECTION. L. Green, Jr. and K. L. Nall. Dec. 31, 1957. 79p. Project No. 6-(1-9964). Contract AF33(616)-3767.

A review of previous investigations of flow separation in supersonic de Laval nozzles indicated a need for experimental data on the effect of the nozzle heat-transfer condition on jet-detachment behavior, and on the feasibility of controlling the point of separation of an overexpanded flow by fluid injection through a porous boundary. An experiment was designed to obtain the desired information by means of pressure-distribution measurements and schlieren observation. Owing to delays in the delivery of quartz nozzle-wall windows of the optical quality required for schlieren photography of high-stagnation-temperature flow patterns, the present investigation was limited to studies in which dry nitrogen was expanded from ambient temperatures. It was found that under these conditions the boundary-injection technique was indeed effective in promoting controlled separation at expansion ratios approaching the optimum value. (auth)

4150 CF-57-9-33
Oak Ridge National Lab., Tenn.
THE PERFORMANCE OF A SMALL HELICAL TUBE HEAT EXCHANGER. C. V. Chester. Dec. 19, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A high-speed solvent extraction contactor is desirable for use in radiochemical processing plants to reduce radiation damage to solvent. Such a contactor is being developed, using steam jets for mixing and pumping and hydroclones for phase separation. A cooler may be necessary after each steam jet to control the temperature of the liquids in the cascade. Minimum holdup, low pressure drop, and dependability are prime requisites of the cooler. A helical tube heat exchanger was designed, constructed, and extensively tested for this service. The holdup was 242 cm^3, average heat transfer area was 0.145 sq. meters, and the pressure drop in the tube was given by:

ΔP (in. Hg) = 0.81 $G_t^{1.65}$, where G_t is tube side flow rate, l/min. (auth)

4151 MND-1062-1
Martin Co., Baltimore.
NUCLEATE BOILING LITERATURE SEARCH. J. J. Jicha and E. J. Lemanski. Apr. 1957. 56p. Contract DA-44-009-ENG-3043.

This report is a Supplement to MND-1062.

The subject matter presented deals with the mechanism of boiling heat transfer which is described in some detail. Following this, the effects of different liquid conditions on this mechanism are discussed. Later the forced convection and nucleate boiling modes of heat transfer are identified, after which partial film boiling is introduced. Equations are presented for various pressure ranges, flow rates, and heating element geometries which predict conditions where boiling will take place. This is followed by a listing of the equations which define conditions under which burnout would occur. Some of the more important variables and their effect on nucleate boiling and burnout are discussed briefly. A glossary of boiling heat transfer terms is included to aid those unfamiliar with the subject in orienting themselves in this field. It is recommended that the reader review the terminology before attempting the report. The information presented is believed to be the best and the latest in the field of nucleate boiling, and should enable a fairly complete analysis to be made of nucleate boiling and burnout in pressurized water reactors. (auth)

4152 NYO-7973
New York Univ., New York. Atomic Energy Commission Computing Facility.
DETACHED-SHOCK CALCULATIONS BY POWER SERIES, I. R. D. Richtmyer. Oct. 15, 1957. 49p. Contract AT(30-1)-1480. $7.80(ph OTS); $3.30(mf OTS).

A method is described for calculating the flow of an inviscid, ideal gas between a blunt body moving at high Mach number and the detached shock that precedes it. The method is based on power-series expansion in two space variables about a point on the shock. Special Univac routines for formal calculation with power series have been developed; they include an interpretive routine of such a nature that the partial differential equations that determine the coefficients of the power series can be transcribed directly into a pseudo-code. An important feature of the method is the use of special floating-decimal subroutines in which the possible loss of significant digits by cancellation is continually monitored. Test calculations that have been made with the method are reported. The results appear to indicate that the method has considerable promise for fluid-dynamical problems of this kind, but further development in certain directions is indicated. (auth)

4153 WAPD-TH-160
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
CORRELATION OF BURNOUT DATA. G. Sonnemann. [July 1956]. 15p. $3.30(ph OTS); $2.40(mf OTS).

A burnout correlation, which takes into account parameters of inlet subcooling and channel length and diameter is described. It does not consider directly the bulk fluid properties at the burnout point. This correlation predicts that the burnout flux increases with increased inlet subcooling and decreases with increased channel length. This is in general agreement with the trends shown by the experimental data. (auth)

4154 WAPD-TH-223
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
PRELIMINARY INVESTIGATION OF BURNOUT AND PRESSURE DROP AT 830 AND 1215 PSIA WITH A PARALLEL

CHANNEL EFFECT. H. Jacket, J. Lackey, J. D. Roarty, and N. C. Sher. July 28, 1956. 21p. $4.80(ph OTS); $2.70(mf OTS).

Preliminary burnout and pressure drop tests were conducted with water at 830 and 1215 psia with upflow through a vertically mounted, electrically heated, rectangular flow channel in parallel with an unheated by-pass line. Single channel burnout data were also obtained. For the parallel channel tests, the by-pass had a flow area more than 30 times that of the flow channel. The heated channel was machined of Zircaloy-2 and measured 0.097 in. × 1 in. × 27 in. long. Tests were conducted at 830 psia with inlet subcoolings of approximately 10 and 60°F, and initial inlet velocities of approximately 6, 8, and 10 ft/sec. Tests were conducted at 1215 psia with approximately 60°F inlet subcooling and initial inlet velocities of 8 and 10 ft/sec. (auth)

4155 WAPD-TH-227

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] ADDITIONAL BURNOUT DATA FOR A RECTANGULAR CHANNEL HAVING A COSINE AXIAL HEAT FLUX DISTRIBUTION. R. A. DeBortoli, J. D. Roarty, and A. Weiss. Aug. 7, 1956. 11p. $3.30(ph OTS); $2.40(mf OTS).

Single channel and parallel channel burnout data were obtained at 2000 psia for 0.057 in. × 2.116 in. × 27 in. long and 0.055 in. × 2.116 in. × 27 in. long machined stainless steel rectangular channels in the vertical position. These channels had a cosine axial heat flux distribution. Previous data for a cosine heated channel are also included. The results indicate that the burnout heat flux in a rectangular channel having a cosine axial flux distribution may be predicted by the method presented in WAPD-SFR-Rs-444. There is no significant effect on burnout heat flux due to an unheated parallel channel. (auth)

4156 WAPD-TH-229

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] ATMOSPHERIC PRESSURE FREE CONVECTION BURNOUT TESTS. R. A. DeBortoli, H. Dobel, and J. D. Roarty. Sept. 25, 1956. 17p. Contract [AT-11-1-GEN-14]. $3.30(ph OTS); $2.40(mf OTS).

Atmospheric pressure, free convection burnout heat flux is significantly affected by the cold leg water level. The burnout flux varied from about 6,000 Btu/hr-ft^2 to 30,000 Btu/hr-ft^2 as the cold leg water level (U-Loop) was raised from about 8 in. below the top of a subassembly to 28 in. above the top of a subassembly. The inlet temperature (80 to 200°F) has a slight effect (15%) on the burnout heat flux; the higher the inlet temperature, the lower the burnout heat flux. The burnout heat flux for a nonuniformly heated subassembly (maximum channel flux/minimum channel flux = 2 or 4) was a little higher (~ 15%) than a uniformly heated subassembly. No significant effect of the maximum-to-minimum flux ratio on the burnout flux could be established. (auth)

4157 WAPD-TH-265

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] PRELIMINARY INVESTIGATION OF PRESSURE DROP AND HEAT TRANSFER IN RECTANGULAR CHANNELS AT 1100 PSIA. N. C. Sher. [1956]. 46p. $7.80(ph OTS); $3.30(mf OTS).

Preliminary design recommendations have been presented for estimating heating, local boiling, and bulk boiling pressure drop during upflow in vertical rectangular channels at 1100 psia. These recommendations are of the same form as previously presented for 2000 psia. The preliminary heat transfer data may be interpreted as showing fair agreement with the Dittus-Boelter and Jens and Lottes correlations for predicting nonboiling and boiling forced convection heat transfer coefficients, respectively. However, uncertainties in the experimental technique prevent revising the existing design equation for calculating forced convection heat transfer coefficients. (auth)

4158 NACA-TM-1431

ON THE STATISTICAL THEORY OF TURBULENCE (Zur statistischen Theorie der Turbulenz). W. Heisenberg. Translated from Z. Physik, 124, 628-57(1948). 36p.

A study is made of the spectrum of isotropic turbulence with the aid of the customary method of Fourier analysis. The spectrum of the turbulent motion is derived to the smallest wave lengths, that is, into the laminar region, and correlation functions and pressure fluctuations are calculated. A comparison with experimental results is included. Finally, an attempt is made to derive the numerical value of a constant characteristic of the energy dissipation in isotropic turbulence. (auth)

Materials Testing

Refer also to abstract 4603.

4159 CF-57-12-57

Oak Ridge National Lab., Tenn.

VALVE TEST LOOP OPERATION—NOVEMBER 23, 1955 THRU OCTOBER 18, 1957. A. M. Billings. Dec. 12, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The operation of the valve test loop for the evaluation of valve trim materials in UO_2SO_4 solution is presented. Armco 17-4 PH stainless steel hardened from Rc 35 to Rc 40 appears best for a valve plug material when used with a 347 stainless steel valve seat. Other materials showing near-equal performance are the 347 stainless steel plug and seat with gold-gasketed tongue and groove and 347 stainless steel plug flame plated with Lende LW-1 working against an unplated 347 stainless steel seat. (W.L.H.)

4160 NP-6521(Vol. IV)

Battelle Memorial Inst., Radiation Effects Information Center, Columbus, Ohio.

PROCEEDINGS [OF] THE SECOND SEMI-ANNUAL 125A RADIATION EFFECTS SYMPOSIUM, OCTOBER 22-23, 1957. 239p.

Papers are presented covering the effects of radiation on polymeric materials, fuels, and lubricants. Topics covered include the effects of radiation on metallo-organic polymers; the mechanism of radiation damage to elastomers; the effects of radiation on reinforced plastics and structural adhesives; the engineering evaluation of radiation effects on organic materials; post irradiation changes in silicone rubber; radiation effects on plastics; a review of the program for the development of nuclear radiation resistant fluids and lubricants, with emphasis on turbine engine lubricants and jet fuels; variation of results of dynamically and statically irradiated aircraft fluids; the dynamic effects of radiation on hydrocarbon fluids under thermal, oxidative, and mechanical stress; the effects of radiation of fluorocarbons and related substances; the development of radiation resistant high temperature lubricants; and the behavior of fuels and lubricants in dynamic test equipment operating in a radiation environment. (C.H.)

4161 NP-6536

Australia. Council for Scientific and Industrial Research.

RADIOACTIVE TRACERS IN THE STUDY OF FRICTION AND LUBRICATION. Lubrication and Friction Report

No. 54 (Serial No. A-142). J. N. Gregory. Jan. 7, 1946. 8p.

The radioactive tracer method may be conveniently used to detect metallic transfer between sliding metal surfaces. This method is of particular value in obtaining a picture of the distribution as well as the amount of the pick-up which occurs during the sliding process and may be used for similar as well as dissimilar metallic combinations. Owing to its softness, lead, which was used in the experiments described, is not particularly well suited for friction work. Future developments of the method will depend on the availability, in an artificially radioactive form, of metals such as copper, iron, zinc and cadmium which have greater practical significance. (auth)

4162 WADC-TR-56-272(Pt. II)
Boeing Airplane Co. Seattle.
DESIGN DATA FOR O-RINGS AND SIMILAR ELASTIC SEALS. [Period Covered] May 1956 to March 1957. R. J. Dunsmoor, H. R. Hack, F. W. Tipton, G. E. Trepus, and R. A. Vickers. June 30, 1957. 106p. Project No. 7340. Contract AF33(616)-2867. (AD-131094).

The relationship between the physical properties of seal materials and sealing efficiency was studied so that materials may be fully utilized in seal design. The literature survey on O-rings and seal design has been continued. Commercially available polymers have been compounded with various physical properties. Static annulus (with varying groove configuration), rotating shaft, and reciprocating shaft functional test jigs have been designed and manufactured. Seal tests, under various environmental and mechanical conditions, have been run in these jigs. No definite relationship between physical properties and seal efficiency was found. A general relationship, however, was evident between seal life, and compression modulus and compression relaxation. (auth)

Pumps

4163 CF-57-12-75
Oak Ridge National Lab., Tenn.
STELLITE PISTON PUMP. E. C. Hise. Dec. 16, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

A direct acting piston pump, a possible alternate for the diaphragm feed pump, was built and tested in water without piston rings and in fuel solution with piston rings. Leakage due to wear rendered it useless in a week in the first case and in a month in the second. Although a development program could probably improve the performance of such a pump, the calculable limitations of it are so severe that it is recommended that the project be discontinued. (auth)

Vacuum Systems

4164
HIGH VACUUM SHAFT SEALS, FLANGED JOINTS AND THE GASSING AND THE PERMEABILITY OF RUBBER-LIKE MATERIALS. R. H. V. M. Dawton (Atomic Energy Research Establishment, Harwell, Berks). Brit. J. Appl. Phys. 8, 414-21(1957) Oct.

Various designs of high vacuum shaft seals are given and their performance measured by the pressure rate of rise in a closed system. Experiments show that there is little to choose between them from their vacuum performance, although the washer in which a tension spring is embedded is at times to be preferred. A large portion of the leak is condensable indicating something more complicated than the direct passage of air through the seal. Experiments give measurements of the gassing from rubber-like materials including neoprene and butyl rubber when totally enclosed in a vacuum system, and also measurements of their permeability to gases. All the synthetic materials tested gassed considerably more than did rubber. In the permeability experiments it was found that the time required for gases to pass through diaphragms varies from several minutes to an hour, depending on the gas. The permeability, unlike the gassing effect, is considerably less with the synthetic rubbers tested than with rubber. Data are given on the testing of flanged gasket joints and their effect on a vacuum system during the first twenty hours of pumping when the joint gassing is liable to be confused with a leak. Data are also given on the flange clamping pressure necessary for a tight joint. (auth)

Waste Disposal

4165 IGRL-IB/R-28
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
TREATMENT AND DISPOSAL OF GASEOUS, LIQUID AND SOLID RADIOACTIVE WASTES. Information Bibliography. Nov. 1957. 34p.

This is a wide selection of unclassified report, book, and journal references to publications issued up to December, 1956. Sources used were U.K., Canadian, and U.S. reports abstracts; Nuclear Science Abstracts; Geneva Conference (1955) papers; Cleveland, Ohio, Nuclear Congress (1955) papers; Engineering Index (1950-1955); and Industrial Arts Index (1956). (auth)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

Refer also to abstract 4608.

4166 AD-120620
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Final Report [for] August 16, 1956 to November 30, 1956. Harry C. Dunegan. Nov. 1956. 89p. Contract AF33(600)-27329.

A method was developed for producing vacuum tight ceramic to metal seals by means of a pressed powder technique. In this method, layers of ceramic and of metal powders were fabricated in one pressing operation. A single firing cycle matured the ceramic, sintered the metal, and developed the bond. The difficulties in overcoming fabricating and firing problems, in selecting compatible material systems, and in determining optimum bonding conditions were described. The results of over ninety different metal, alloy, and metal oxide mixtures in combination with approximately thirty ceramic formulations were listed. Phase changes in the metallic layers close to the interfaces were used to explain certain types of bonding. (auth)

4167
THE $\gamma \rightarrow \alpha$ TRANSITION IN ZIRCONIA SOLID SOLUTIONS, WITH LIME AND MAGNESIA. E. B. Allison and J. Taylor. Trans. Brit. Ceram. Soc. 54, 677-92(1955).

The heats of transition for $\gamma \rightarrow \alpha$-$ZrO_2$ containing small oxide additions of lime and magnesia are compared. Both the heat and temperature of transition progressively decrease with increasing oxide addition, lime being more effective than magnesia when the additions are compared on a molecular basis. A tentative phase diagram is constructed for the ZrO_2–CaO system in the region where α-ZrO_2 and γ-ZrO_2 co-exist. This, in conjunction with thermodynamic considerations, is used to explain the decrease in the heat and temperature of transition with increasing additions. (auth)

4168

INVESTIGATION OF OXIDATION RESISTANCE OF TITANIUM AND NIOBIUM BORIDES. V. S. Neshpor and G. V. Samsonov. Zhur. Priklad. Khim. 30, 1584-8(1957) Nov. (In Russian)

Oxidation resistance of TiB_2 and NbB_2 and their alloys forming a continuous series of solid solutions was studied with borides of roentgenographic density TiB_2 = 4.53 and NbB_2 = 7.08 g/cm^3 and the lattice parameters of titanium and niobium borides a = 3.028 A, c = 3.224 A and a = 3.082 A, c = 3.278 A, respectively. (R.V.J.)

4169

CONSTITUTION DIAGRAMS OF Na_3AlF_6–Li_3AlF_6–Al_2O_3. V. P. Mashovets and V. I. Petrov (All Union Aluminum–Magnesium Inst.). Zhur. Priklad. Khim. 30, 1695-8(1957) Nov. (In Russian)

Corrosion

4170 BMI-1237

Battelle Memorial Inst., Columbus, Ohio.

THE CORROSION OF MONEL AND 70-30 CUPRONICKEL IN HYDROFLUORIC ACID. Walter J. Braun, Frederick W. Fink, and G. Lee Ericson. Dec. 3, 1957. 21p. Contract W-7405-eng-92. $0.75(OTS).

Monel is shown to be suitable for the handling of 10 to 70% HF at 140°F and for handling 38 and 48% acid at boiling; cupronickel also is useful over part of this range. Elimination of O_2 is necessary to achieve maximum corrosion resistance. Some accelerated interface attack was noted for 70-30 cupronickel. Welding of Monel is the preferable joining method. Silver solder joints are subject to embrittlement. Work hardening, annealing, and external stress do not significantly influence the corrosion of Monel. Galvanic coupling of Monel with silver or silver solder is to be avoided. (auth)

4171 KAPL-M-SMS-89

Knolls Atomic Power Lab., Schenectady, N. Y.

CORROSION PRODUCT TRANSPORT STUDY IN THE KAPL-37 LOOP. F. C. Steiner and F. J. Witt. Dec. 23, 1957. 24p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

Experiments to study the transport of radioactive crud from contaminated out-of-pile surfaces to a newly installed precorroded pipe section in the KAPL-37 loop are described. The section installed formed a thimble by-pass. The radiochemical analyses of routine water and crud samples are tabulated and discussed. (T.R.H.)

4172

A CATALYTIC MECHANISM OF ANODIC INHIBITION IN METALLIC CORROSION. R. A. U. Huddle and P. J. Anderson (Atomic Energy Research Establishment, Harwell, Eng.). Advances in Catalysis 9, 393-7(1957).

It is well known that quite low concentrations of certain oxygen-containing anions, such as chromate, are effective inhibitors of aqueous corrosion of a number of metals. These results have been ascribed to specific adsorption of the inhibitor at anodic sites of the metal surface, or alternatively to continuous repair of the protective film. Work on the corrosion of aluminum has suggested that its resistance is largely dependent on the structure of the film; thus, complete passivity is considered to be associated with the formation of an oxide, while a hydrated oxide or hydroxide film only confers partial protection. It is postulated that the important factor in inhibition by oxygen-containing anions is their ability to cause the true oxide to be produced rather than the hydroxide which would otherwise form. It is thought that the anion acts catalytically in donating its own O^{2-} ion to the film in competition with the hydroxyl ion from the solution. These ideas are shown to apply to other metals in addition to aluminum and explain a number of facts which are inconsistent with existing theories of anodic inhibition. (auth)

4173

MASS TRANSFER. A. K. Covington, G. A. Geach, and A. A. Woolf (Associated Electrical Industries, Ltd., Aldermaston Court, Berks.). Atomics and Nuclear Energy 9, 10-11, 34(1958) Jan.

The mechanisms of mass transfer in reactors are briefly reviewed. Two major classes, thermal gradient and isothermal mass transfer, are considered. (D.E.B.)

4174

THESE ALUMINUM ENAMELS RESIST CORROSION BY BOILING ALKALINE WATER. B. W. King and W. H. Duckworth (Battelle Memorial Inst., Columbus, Ohio) and John Schultz and H. P. Tripp (General Electric Co., Louisville, Ky.). Ceram. Ind. 69, No. 4, 82-4(1957) Oct.

Enamels for 2S aluminum were developed which exhibited corrosion rates of about 1/75 that of bare aluminum when exposed to boiling alkaline water for 100 hours. These enamels were based on the Na_2O–PbO–SiO_2 eutectic composition with substitutions of a total of 10 to 15 weight % of TiO_2, ZrO_2, and alkaline earth oxides for PbO and Na_2O. About 1 weight % NiO was beneficial for promoting adherence. (auth)

4175

EFFECTS OF IRRADIATION ON CORROSION RESISTANCE OF SOME HIGH URANIUM ALLOYS. Sherman Greenberg and Joseph E. Draley (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 19-28(1958) Jan.

Three corrosion resistant U base alloys were corrosion-tested in high temperature water: U–5% Zr–1½% Nb, U–3% Nb–0.5% Sn, and U–3.8% Si. Only the U–3.8% Si alloy retained any degree of corrosion resistance after burnups in excess of 0.1 at. %. Low burnup did not adversely affect the corrosion resistance of the diffusion bond between U–2% Zr alloy and its Zircalloy-2 cladding. (auth)

4176

INVESTIGATION OF OXIDATION OF ALLOYS CONTAINING INTERMETALLIC COMPOUNDS OF NiAl. E. I. Mozzhukhin, L. Kh. Pivovarov, and Ya. S. Umanskii (Moscow Steel Inst.). Zhur. Priklad. Khim. 30, 1593-9(1957) Nov. (In Russian)

The heat resistance of single-phase alloys of NiAl and two-phase alloys of NiAl + Ni_3Al was investigated at 870, 1000, and 1150°C. (R.V.J.)

Geology and Mineralogy

4177 NP-tr-2

ON THE MECHANISM OF THE ACTION OF NON-POLAR REAGENTS IN THE FLOTATION OF COAL. V. I. Klassen and I. N. Plaksin. Translated by S. Botcharsky from Doklady Akad. Nauk S.S.S.R. 95, 953-5(1954). 5p.

4178
THE BLIND RIVER URANIUM FIELD OF CANADA-1. L. D. Roland (Permutit Co., Ltd.). Atomics and Nuclear Energy 9, 12-15(1958) Jan.

4179
LITHOFACIES OF THE SALT WASH MEMBER OF THE MORRISON FORMATION, COLORADO PLATEAU. Thomas E. Mullens and Val L. Freeman. Bull. Geol. Soc. Amer. 68, 505-26(1957) Apr.

The Salt Wash is the basal member of the Upper Jurassic Morrison Formation in parts of Utah, Colorado, Arizona, and New Mexico. Deposited by streams, it comprises lenticular beds of cross-laminated sandstone irregularly interbedded with mudstone, siltstone, claystone, and horizontally laminated sandstone. The term "lithofacies," as used in this paper, denotes lithologic aspect. The specific lithofacies of the Salt Wash member at a given locality is determined by the thickness, proportion, and continuity of the stream and flood-plain deposits that make up the Salt Wash. Stream deposits include all rocks interpreted as deposited from moving water; flood-plain deposits include all rocks interpreted as deposited from slack water. Regional differences in lithofacies show that the Salt Wash member is a fan-shaped wedge of sedimentary rocks whose apex is in south-central Utah. Within the wedge, the thickness of the Salt Wash and the thickness, proportion, and continuity of the contained stream deposits decrease relatively uniformly to the north, northeast, and southeast of the apex. Interpretation of the regional differences in lithofacies indicates deposition by a distributary stream system whose apex was in south-central Utah and which spread sediments to the north, east, and southeast over a nearly flat plain. Irregularities on this plain near the Four Corners area and in west-central Colorado modified the distributary system, and therefore the wedge is not symmetrical. Most uranium-vanadium ore deposits in the Salt Wash member occur in a lithofacies near the center of the wedge. This may be a genetic relation and can be explained as a function of transmissibility of the particular lithofacies. The ore deposits, however, are concentrated in a relatively small part of the central lithofacies. Because local geologic features such as structure or igneous intrusions might control the localization of ore deposits in the small area, the high degree of correlation of ore deposits and a certain lithofacies may be coincidental. (auth)

4180
OCCURRENCE OF SELENIUM IN SULFIDES FROM SOME SEDIMENTARY ROCKS OF THE WESTERN UNITED STATES. R. G. Coleman and Maryse Delevaux (U. S. Geological Survey, Menlo Park, Calif.). Econ. Geol. 52, 499-527(1957) Aug.

Investigations of the minor- and trace-element content of sulfides associated with U ore deposits from sandstone-type deposits have shown that Se commonly substitutes for S. The Morrison formation and Entrada sandstone of Jurassic age and the Wind River formation of Eocene age seem to be seleniferous stratigraphic zones; sulfides deposited within these formations generally contain abnormal amounts of Se. The Se content of the pyrite, marcasite, and chalcocite is much greater than that reported in previously published data. Under the prevailing temperatures and pressures of formation of the Colorado Plateau U deposits the maximum amount of Se substituting for S in the pyrite structure was found to be 3% by weight. Ferroselite, the iron selenide ($FeSe_2$), was found in two deposits on the Colorado Plateau and it was also established that galena (PbS) forms an isomorphous series with clausthalite (PbSe) in nature. During oxidation of the Se-bearing sulfides and selenides from the Colorado Plateau and Wyoming, the selenium forms pinkish crusts of either monoclinic or hexagonal native Se intergrown with soluble sulfates, suggesting that under "normal" oxidizing conditions native Se is more stable than selenites or selenates. The above-normal Se content of these sulfides from sedimentary rocks of Mesozoic and Tertiary age is significant. The high Se in these sulfides is related to periods of volcanic and intrusive activity penecontemporaneous with the formation of the containing sediments. (auth)

4181
PLEOCHROIC HALOES AND THE ARTIFICIAL COLORATION OF BIOTITES BY α PARTICLES. S. Deutsch, P. Kipfer, and E. Picciotto. Nuovo cimento (10) 6, 796-810(1957) Oct.

The α doses necessary for the formation of pleochroic haloes in biotites of various granites are reported. The coloration first appears after a dose of 2.10^{13} α/cm^2, in agreement with the earliest results obtained by Joly and Rutherford on the biotites of pegmatite. (M.H.R.)

4182
PRELIMINARY TECTONIC MAP OF WESTERN NORTH DAKOTA, SHOWING THE DISTRIBUTION OF URANIUM DEPOSITS. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 125. R. W. Osterwald and B. G. Dean. Washington, U. S. Geological Survey, 1957. $0.50.

4183
PRELIMINARY TECTONIC MAP OF WESTERN SOUTH DAKOTA, SHOWING THE DISTRIBUTION OF URANIUM DEPOSITS. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 128. F. W. Osterwald and B. G. Dean. Washington, U. S. Geological Survey, 1957. $0.50.

4184
PHOTOGEOLOGIC MAP OF THE RAINBOW POINT SW QUADRANGLE KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-257. P. P. Orkild. Washington, U. S. Geological Survey, 1957. $0.50.

Metals and Metallurgy

Refer also to abstracts 4586, 4607, 4609, and 4610.

4185 56-RL-1561
General Electric Co. Research Lab., Schenectady, N. Y.
A METHOD FOR THE ETCHING OF METALS BY GAS ION BOMBARDMENT. J. B. Newkirk and W. G. Martin. June 1956. 12p.

An improved method for the etching of metal surfaces by bombardment with gas ions is described. Novel features, including the use of Kr as the etching agent and the application of a magnetic field in the ionization chamber, have made it possible to etch metallographic specimens more rapidly and with less heating of the specimen than has been reported heretofore. (auth)

4186 A-2388(WEC)
Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.
DEVELOPMENT OF NIOBIUM BASE ALLOYS. Quarterly Progress Report No. 5 [for] March 15, 1957 to June 15, 1957. R. T. Begley. June 1, 1957. 35p. Contract AF33(616)-3316.

Niobium of high purity with respect to interstitial contaminants was produced by cage-zone melting. The recrystallization behavior, ductile-to-brittle transition properties, and electrical resistivity of the high purity cage-zone melted material were determined. Recrystallization and electrical resistivity studies were also conducted on Nb provided by a supplier using an electron bombardment technique to melt the material. The electron

bombardment process was found to be extremely effective in reducing the level of gaseous contaminants. Flexure fatigue studies on annealed and cold worked powder metallurgy Nb were completed. A new multiple hearth levitation melting unit was designed for melting of alloys for phase diagram studies. Effort continued on the development of analytical techniques and the preparation of a new chamber for welding studies. (For preceding period see A-2293-WEC.) (auth)

4187 HW-48978

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FUSION WELDING OF Al–Si BONDED FUEL ELEMENTS. Thomas B. Correy. Mar. 11, 1957. 83p. Contract W-31-109-Eng-52. $12.30(ph OTS); $4.50(mf OTS).

Smooth, shiny, homogeneous, laboratory quality welds of Al and its alloys that are virtually free of porosities, surface oxides, and inclusions can be produced on a production basis by using the inert gas shielded tungsten electrode alternating current arc process. (W.L.H.)

4188 KAPL-1747

Knolls Atomic Power Lab., Schenectady, N. Y.

RATE OF GROWTH OF DIFFUSION LAYERS IN U–Al AND U–AlSi COUPLES. L. S. DeLuca and H. T. Sumsion. May 1, 1957. 34p. Contract W-31-109-Eng-52. $1.00 (OTS).

The rates of growth of diffusion layers between U and Al and between U and AlSi alloy (eutectic composition) were studied and compared over the temperature range 250 to 550°C. Metallographic observation shows that the U–Al reaction layers form three to five times as fast as the U–AlSi layers over this temperature range. Sixty per cent of the layer growth takes place in the Al or AlSi alloy and 40% in U. (auth)

4189 MAB-127-M

National Research Council. Materials Advisory Board.

INTERIM RECOMMENDATIONS FOR HEAT TREATMENT OF DOD TITANIUM SHEET ROLLING ALLOYS. First Report by Subpanel on Heat Treatment. Jan. 10, 1958. 5p. Contract DA-49-025-sc-83.

Heat treatment of Ti sheet rolling alloys containing Ti–Al–V, Ti–Al–Mo–V, and Ti–Al–Mo are given. (W.L.H.)

4190 NAA-AL-2073

North American Aviation, Inc., Downey, Calif.

ELEVATED TEMPERATURE STRUCTURAL EFFICIENCY EVALUATION OF VARIOUS METALS. Dec. 1954. 20p. Contract AF-33(616)-371.

The results of an evaluation of structural efficiencies of various materials at elevated temperatures are presented in graphical form. The compressive yield stress-density ratio is plotted versus temperature (to 700°F). Also a column structural index and a plate structural index are plotted vs the critical stress-density ratio at room temperature, 500°F and 700°F. Several types of steel and some Mg, Al, and Ti alloys were tested. On a compressive yield basis, Natanium A, AMS 4908, and 17-7 PH are the three most efficient materials for room, intermediate, and high temperatures, respectively. For columns and plates at elevated temperatures the titaniums are the most efficient. (auth)

4191 NRL-5034

Naval Research Lab., Washington, D. C.

INVESTIGATION OF BETA PHASE "RECRYSTALLIZATION" IN Ti–3% Al–5% Cr ALLOY. K. B. Lloyd and E. J. Chapin. Sept. 19, 1957. 21p.

A study was conducted to explore the possibility of controlling the beta grain size during heat treatment of binary and ternary titanium alloys with aluminum and chromium and to determine the resulting effects on mechanical properties. Beta grain behavior was studied in binary and ternary titanium alloys within the composition ranges of aluminum and chromium normally found in the commercial MST Ti–3Al–5Cr alloy. These amounts included: 2.5, 3.1, and 3.75 wt. % aluminum; 4.3, 4.65, and 5.0 wt. % chromium; and combinations thereof. Unalloyed arc-melted iodide and sponge titanium were also included for reference purposes. A preliminary transformation temperature survey was made on the unalloyed titanium and the binary and ternary alloys with aluminum and chromium to determine the optimum heat treatment temperatures for obtaining small beta grains. The binary titanium–aluminum alloy compositions studied did not form networks of small beta grains when heat treated just below their transus. The absence of this characteristic prevented control of beta grain growth during heat treatment. The tensile properties were not significantly affected by either the differences in microstructure or by different heat treatments. Networks of small transformed beta grains were obtained in the microstructures of both the binary titanium–chromium series and the ternary titanium alloy series. Chromium promoted the formation of small beta grains at temperatures just below the transus in both binary and ternary series. The tensile strengths of the binary titanium series with chromium were not changed signficantly by heat treatment just under or just above the transus; the alloys were brittle whether the microstructure was composed of small transformed beta grains or of large transformed acicular beta grains. The presence of small beta grain networks appeared to improve the tensile strength of ternary alloys heat treated just under the transus over the strength of forged material, but with some reduction in elongation. Changing proportions of primary alpha and transformed beta in the microstructures, however, obscured the net effects of the small beta grain networks on the tensile properties. The method of improving mechanical properties by control of beta grain size through heat treatment is sensitive to variations in composition or to inhomogeneity in the alloys and to the interstitial contamination normal in commercial fabrication. This method therefore would not be promising for commercial application. The modulus of elasticity was found to vary with heat treatment in this study, indicating that an improvement of this property in titanium alloys may be possible by heat treatment. (auth)

4192 NYO-4771

Massachusetts Inst. of Tech., Cambridge.

FOLD FORMATION AND GRAIN BOUNDARY SLIDING DURING CREEP. A. R. Chaudhuri and N. J. Grant. Dec. 1957. 32p. Contract AT(30-1)-1973. $6.30(ph OTS); $3.00(mf OTS).

The accommodation process of fold formation which occurs in the grains when grain boundary sliding takes place has been studied. Specimens of Al, Al–20% Zn, and Al–Cu alloys were deformed in creep. The process of deformation was observed either directly during creep or after the specimen had been unloaded. Aluminum–20% Zn specimens were also quenched and aged, and the preferential precipitation occurring on aging was studied in relation to fold formation. (auth)

4193 SO-2054

General Electric Co. Research Lab., Schenectady, N. Y.

THERMODYNAMICS OF ORDERING ALLOYS. III. ENERGIES OF TRANSFORMATION OF THE Au_3Cu_1 PHASES. R. A. Oriani and W. K. Murphy. Jan. 1958. 9p. Contract W-31-109-Eng-52. (58-RL-1882). $1.80(ph OTS); $1.80(mf OTS).

Energy differences among the two superlattices and the disordered solid solution at the composition $Au_{\frac{1}{2}}Cu_{\frac{1}{2}}$ have been derived from calorimetric measurements of the heats of formation of the three phases. It is shown that neither of these transitions is understood in terms of quasi-chemical theory. (auth)

4194 TML-87

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

PRINCIPLES AND APPLICATION OF HEAT TREATMENT FOR TITANIUM ALLOYS. A. J. Griest and P. D. Frost. Dec. 27, 1957. 134p. Contract AF18(600)-1375.

This report summarizes the state of the art of Ti heat treatment as of Spring, 1957. In the first section, the relationships between alloy constitution, microstructure, and properties obtained on heat treatment are discussed. The second section consists of a collection of property data for selected commercial alloys in the heat-treated condition. Room-temperature and short-time-elevated temperature data are presented for all of the alloys. When available, impact energy data, creep data, stress stability data, fatigue data, and hardenability data are included. The final section of the report discusses heat-treating practice, including furnace characteristics, coatings for minimizing contamination, and procedures for the control of distortion and flatness during heat treatment. (auth)

4195 TML-91

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

STATUS OF HIGH-STRENGTH STEELS FOR THE AIRCRAFT INDUSTRY. R. J. Nekervis, C. H. Lund, and A. M. Hall. Jan. 3, 1958. 102p. Contract AF18(600)-1375.

Six major classes of steel were found which show promise for application in aircraft for skins and other shapes such as bar stock, forgings, and castings. (W.L.H.)

4196 UK/C/6/108

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EFFECT OF NEUTRON IRRADIATION ON MECHANICAL PROPERTIES OF FERRITIC STEELS. [Paper Presented at] Sixth UK/Canada Technical Conference, Chalk River, Ontario, October 21-22, 1957. L. P. Trudeau. Sept. 1957. 9p.

This report summarizes the data obtained to date in an investigation of the effect of neutron irradiation on the mechanical properties of ferritic steels and irons. (auth)

4197 WADC-TR-56-184(Pt. II)

Battelle Memorial Inst., Columbus, Ohio.

THE PRINCIPLES OF DISPERSION HARDENING WHICH PROMOTE HIGH-TEMPERATURE STRENGTH IN IRON-BASE ALLOYS. Period covered: January 14, 1956 to January 13, 1957. Ervin E. Underwood, Lyle L. Marsh, and George K. Manning. Aug. 22, 1957. 69p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: INTERACTIONS, IMPERFECTIONS, AND ALLOY THEORY. Contract AF33(616)-2785. (AD-142126).

The strength properties of an Fe–20% Cr-base alloy, as influenced by ternary additions of Be, Ti, V, Mn, Co, or Ni, were studied from 80 to 1500°F. Property changes in these single and polyphase alloys were followed by means of creep, tensile, and hardness tests, augmented by metallographic and x-ray measurements. Although room-temperature tensile strengths increased initially with solute concentration, creep-rupture tests at 1200°F revealed solid-solution softening. Alloys with the greatest room-temperature lattice distortion exhibited the greatest decrease in rupture stress. A periodicity was found in the strengthening influence of ternary solutes, whereby the further the solute element stood from Fe (in the fourth period of the periodic table), the greater the strength increase. A qualitative correspondence was established between the slopes of time-dependent hot-hardness curves and the slopes of stress-rupture time curves. These "stability" curves are similar to those of "break" temperatures for the same alloys. The strength-hardness correlation, proposed earlier, has received considerable experimental confirmation. A linear relation is suggested between the strengthening due to particles at 1200°F and their spacing, and for the particular alloy and conditions studied, the strengthening increment increases with increasing particle spacing. (auth)

4198 WADC-TR-56-395(Pt. I)

Syracuse Univ., N. Y.

DESIGN PROPERTIES OF HIGH STRENGTH STEELS IN THE PRESENCE OF STRESS CONCENTRATIONS. PART I. DEPENDENCE OF TENSION AND NOTCH-TENSION PROPERTIES OF HIGH-STRENGTH STEELS ON A NUMBER OF FACTORS. [Period covered] September 1, 1955 to August 31, 1956. B. B. Muvdi, G. Sachs, and E. P. Klier. Dec. 1956. 65p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN AND EVALUATION DATA FOR STRUCTURAL METALS. Contract AF33(616)-2362. (AD-110637).

In this report are presented the results of tension and notch-tension tests performed on hot-rolled sections from commercial, electric furnace heats of 4340, V-Mod. 4330, 98B40, Tricent (Inco), Super Hy-Tuf, Hy-Tuf and Super TM-2 steels. Tension tests were conducted on 0.28 in. diam. specimens. An exception was a single test completed on a smooth 0.9 in. diam. 4340 steel specimen in order to examine the effect of section size on the tension properties of this steel. Notch-tension tests were performed on 0.3, 0.5, and 0.9 in. diam. specimens that were heat treated to strength levels ranging between 180,000 and 300,000 psi approximately. These specimens were provided with notches leading to stress-concentration factors, K, of 3, 5, and 10. In both instances (tension and notch-tension tests) longitudinal and transverse specimens were examined. Furthermore, information from the literature pertaining to the effects of as-processed section size is considered and evaluated. In general, the tensile strength was found to be independent of the specimen orientation, but to decrease gradually with increase in the specimen size. The ductility of smooth specimens, however, was observed to depend on both specimen orientation and specimen size. The notch strength decreased with increase in stress concentration, specimen diameter and as-processed section size. It also decreased as the specimen orientation was changed from longitudinal to transverse. These effects were pronounced at high strength levels and diminished, with decrease in the tensile strength, to insignificant values at strength levels below 200,000 psi. (auth)

4199 WADC-TR-56-395(Pt. 3)

Syracuse Univ., N. Y.

DESIGN PROPERTIES OF HIGH-STRENGTH STEELS IN THE PRESENCE OF STRESS CONCENTRATIONS AND HYDROGEN EMBRITTLEMENT. PART 3. THE RESPONSE OF HIGH-STRENGTH STEELS IN THE RANGE OF 180,000-300,000 PSI TO HYDROGEN EMBRITTLEMENT FROM CADMIUM ELECTROPLATING. Period Covered: September 1, 1955 to August 31, 1956. E. P. Klier, B. B. Muvdi, and G. Sachs. Aug. 31, 1956. 128p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN AND EVALUATION

DATA FOR STRUCTURAL METALS. Contract AF33(616)-2362. (AD-118167).

The embrittlement of high strength steels due to the action of H introduced by Cd-electroplating was studied in sustained-load, rotating beam fatigue, and bending tests. Strength levels from 180,000 to 300,000 psi as suitable for the various steels were examined for a variety of initial conditions of stress concentration. All steels were found to be embrittled in some measure after Cd-plating and this embrittlement could not be fully eliminated, as determined in the bend test, through the baking treatment used. The improvement in properties which did result from baking was promoted by a redistribution and not an elimination of H from the steel. Failure promoted by Cd-plating is affected by the experimental conditions and has been discussed at length in the report. In the H bearing zone a crack is initiated and then depending on the experimental conditions may propagate to failure of the cross section through overloading. Crack development is apparently dependent, in part, on the composition and is minimized by reduction in C content or by an increase in Si content. Both the sustained-load and bend tests are suitable tests for evaluation of H embrittlement in ultra-high strength steels. The rotating beam fatigue test is a relatively insensitive test of H embrittlement, but can be used to provide an excellent measure of the "static" notch strength of the steel. (auth)

4200 WADC-TR-57-242

Crucible Steel Co. of America, Pittsburgh.

INVESTIGATION OF Fe–Mn–Cr–N–C SYSTEM FOR HEAT RESISTANCE AND OXIDATION RESISTANCE BETWEEN 1200 F AND 2000 F. [Period covered] January 1956 to December 1956. Chi-Mei Hsiao and Edward J. Dulis. Sept. 4, 1957. 157p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3318. (AD-142086).

A comprehensive study of wrought Cr–Mn–C–N steels was conducted with the objectives, of developing outstanding elevated-temperature steels that contain a minimum amount of strategic alloying elements, and of advancing the existing knowledge of this new type of steel. Based on the results of the present investigation, phase boundaries of the base compositions of stable austenitic Cr–Mn–C–N steels have been established, and the effects of these elements and of V, W, Mo, and Nb on the microstructures, and the room- and elevated-temperature properties of the steels have been evaluated. A nomograph was prepared to facilitate the designing of the base compositions of these steels, and the estimating of their room- and elevated-temperature properties. These steels are not as resistant to oxidation as are the Cr–Ni steels at comparable Cr levels. However, Cr–Mn–C–N base steels that have properly balanced compositions possess an excellent combination of strength and ductility at both room- and elevated-temperatures. For example, a steel containing 0.6 C, 12 Mn, 24 Cr, 0.7 N, 0.4 V, 2 W, and 0.9 Nb, had a 185,000 psi tensile strength, a 120,000 psi yield strength, a 48% elongation, and a 40% reduction of area. Also, its rupture strength was superior to those of 16 Cr–25 Ni–6 Mo, N155, 19-9DL, and A-286 in the temperature range of 1200 to 1400°F. (auth)

4201 WADC-TR-57-420

New York Univ., New York. Coll. of Engineering.

STUDY OF MICRODISTRIBUTION OF INTERSTITIAL ELEMENTS IN TITANIUM BY INTERNAL FRICTION TECHNIQUES. Period covered: March 1, 1956 to February 28, 1957. Devendra Gupta and Sheldon Weinig. Aug. 1957. 50p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-3393. (AD-142145).

An investigation of the microdistribution of interstitial elements in Ti and Ti binary alloys and its effect on the mechanical properties was initiated. The experimental techniques which were utilized during this period were internal friction measurements and "hard" tensile testing. A study of the solute atom-dislocation interaction of Ti–O alloys was performed. It was found that the behavior of the phenomenon was in accord with the relationship C = Coexp (V/KT). The interaction energy between an O atom and a dislocation was calculated to be 0.015 ev. The O content required to saturate the dislocations was found to be approximately 1.5%. It was also observed that the transition from ductile to brittle behavior occurred at the same composition. It was suggested that the transition phenomenon was due to the adsorption of O atoms at the dislocations. In view of this suggestion it was possible to predict the proper treatment to shift the onset of the embrittling effect to higher O contents. This was demonstrated experimentally and it was possible to increase the ductility of Ti–O alloys. It was demonstrated that an interstitial stress relaxation phenomenon could be observed in "superpurity" Ti. The development of the interstitial peak in alpha Ti is shown to be directly related to the atomic size of the substitutional element in solution with the O. The greater the difference in size factor between the solute and the Ti atom, the greater the enhancement of the "interstitial" peak. It is suggested that the mechanism whereby the substitutional solute atoms enhance the appearance of the interstital peak is as follows: The out-of-size substitutional atom causes a localized distortion of the lattice which effectively destroys the isotropic nature of the octahedral interstitial sites. Hence, one site becomes energetically favorable to another upon the application of an external stress. This causes a stress-induced interstitial relaxation phenomenon which is manifested by the appearance of an internal friction peak. (auth)

4202 WAL-TR-401/216-1

Watertown Arsenal Lab., Mass.

MECHANICAL PROPERTIES AND STRUCTURES OF LOW-ALLOY TITANIUM WELD DEPOSITS. Daniel M. Daley, Jr. Dec. 1957. 25p. DA Project 5B92-05-007.

Various compositions of alloy filler material were deposited in a single heat of ¼-in. unalloyed titanium using the inert-gas-shielded tungsten-arc process. The filler materials were binary alloys containing three or more levels of iron, molybdenum, manganese, chromium, or silicon. Evaluation of the weldments was made in the as-welded condition using sub-size tensile and notch-bar impact specimens. The hardness, chemical analysis, and microstructure of the weld deposits were also determined. In general, the results obtained confirmed the earlier findings of this and other laboratories, viz., that alloys containing small additions of the beta-stabilizing elements produce welds with good tensile strength, ductility, and toughness. (auth)

4203 WAPD-RM-52

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

INVESTIGATION OF THE EFFECT ON CORROSION RESISTANCE OF Zr CRYSTAL BAR, OF Zr IODIDES AND HIGH TEMPERATURE CERAMICS. H. R. Hoge and Z. M. Shapiro. May 23, 1951. Changed from OFFICIAL USE ONLY Dec. 1957. 8p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

The effect on the corrosion resistance of Zr crystal bar, of ZrI_4 condensed on the bars at the conclusion of the runs, and of treated and untreated ceramics used in the de Boer vessels, was investigated. It was concluded that the ZrI_4 does not affect the corrosion resistance. It was also found that new high temperature ceramics, and those

cleaned by sandblasting do not affect the corrosion resistance, while those cleaned by a solution of HF and H_2SO_4 definitely impair the corrosion resistance of the crystal bars. (auth)

4204 WAPD-TM-104

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. HYDROGEN REDISTRIBUTION IN THIN PLATES OF ZIRCONIUM UNDER LARGE THERMAL GRADIENTS. J. M. Markowitz. Jan. 1958. 33p. Contract AT-11-1-GEN-14. $1.00(OTS).

By using experimental data, the quantities determining the extent of dissolved H redistribution under a thermal gradient in Zircaloy were calculated. It is concluded that the phenomenon of hydride precipitation by means of thermal gradient diffusion of dissolved H in Zircaloy fuel plates and cladding places much more severe restrictions on the allowable pre-operation H content of such elements than was hitherto suspected. The specific effects of operating conditions on H content of plates and cladding are presented in detail. (M.H.R.)

4205 NP-tr-15

THE KIRKENDALL EFFECT IN SILVER–GOLD ALLOYS THROUGHOUT THE WHOLE RANGE OF CONCENTRATION. Theodor Heumann and Guntram Walther. Translated by N. Willis from Z. Metallk. 48, 151-7(1957). 14p.

The migration effect of marked planes in the diffusion of binary metallic mixed crystals of the substitutional type has been considered, and on this basis a variation of the density of vacancies should occur on account of the different velocities of migration. This variation gives rise to a maximum on the side of the faster component and a minimum on the side of the slower component. The equalization of the density distribution of vacancies, which takes place by a mechanism not yet known, should cause the displacement of marked planes to be in the same direction as that of the welded plane only inside the extreme positions. Outside these extreme positions, and thus at the ends of the diffusion zone, the direction is reversed. An experimental proof was carried out for the case of Ag–Au diffusion by welding thin films on the front sides of the two samples. The welded joints themselves served as markers and they could be measured with sufficient accuracy. Similar experiments showed the reversal of direction at the Au or Ag rich ends of the diffusion curve. The films caused no additional disturbance to the course of the diffusion. (auth)

4206 NP-tr-23

THE SEPARATION PROCESS IN COPPER–BERYLLIUM ALLOYS. W. Gruhl and G. Wassermann. Translated by J. H. Montague from Metall 5, 141-5(1951). 12p.

The separation of Cu–Be alloy was investigated resistometrically, roentgenographically, and metallographically for an alloy with 1.82% Be. It can be shown that for Cu–Be the single-phase de-mixing is associated with a resistance increase and the separation with a decrease. Above 325° a direct separation of the compound Cu–Be occurs. Below 325° the formation of Guiner-Preston zones comes first. Out of the previously existing atomic arrangement there first forms a tetragonal body-centered intermediate phase with superstructure which then goes over to the body-centered cubic lattice of the stable Cu–Be compound. A cold deformation applied after quenching leads, independently of the temperature, to a spontaneous separation of the γ end phase, so that the formation of the intermediate phase γ' is suppressed. It can be shown roentgenographically that the β and γ phases are identical. This result makes a change in the Cu–Be state diagrams necessary. (auth)

4207

THE EFFECT OF PRESSURE UPON VOID FORMATION IN DIFFUSION COUPLES. R. S. Barnes and D. J. Mazey (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Acta Met. 6, 1-7(1958) Jan.

Sandwiches of Cu and Ni have been diffused under various hydrostatic pressures. This reduces the number of voids and above a critical pressure there are no voids. Similarly, voids previously formed by an anneal in vacuo are eliminated by applying pressure during a subsequent heat treatment, but the critical pressure is greater than that necessary to prevent them forming. It is concluded that the vacancy supersaturation is about 1% and that the voids nucleate heterogeneously upon nuclei (about 10^{-5} cm in size) which are included in the weld between the two metals. There is no evidence of an alteration in the diffusion coefficient of Cu and Ni with the pressures used. (auth)

4208

METALLURGICAL DEVELOPMENT AND ATOMIC ENERGY. John Cockcroft (Atomic Energy Research Establishment, Harwell, Berks.). Atomics and Nuclear Energy 9, 5-6(1958) Jan.

A general review of some of the metallurgical problems associated with reactor fuel elements is presented. (D.E.B)

4209

METALLURGICAL RESEARCH. W. E. Dennis (G. E. C. Research Labs., Erith, Kent). Atomics and Nuclear Energy 9, 7-9(1958) Jan.

The use of CO_2 reactor coolant introduced problems peculiar to a given reactor due to CO_2 reactions with specific materials. CO_2 reactions with graphite, Mg, Fe, and H_2 are discussed, and their consequences in a reactor are considered. (D.E.B.)

4210

ROLLING MILLS FOR FUEL ELEMENTS. A. I. Nussbaum (Stanat Manufacturing Co., Inc., Westbury, N. Y.). Atomics and Nuclear Energy 9, 16-19(1958) Jan.

Rolling and fabrication of the new metals required for the atomic age involved a series of problems unencountered before. These required special equipment, special care to avoid radioactive hazards, and a knowledge of the properties of the materials. (auth)

4211

Ti–7Al–3Mo ALLOY STAYS STRONG AT HIGH HEAT. F. A. Crossley (Illinois Inst. of Tech., Chicago). Iron Age 181, No. 3, 76-8(1958) Jan. 16.

4212

INVESTIGATIONS OF DECOMPOSITION OF Ni–Be ALLOY. N. N. Buinov, L. I. Podrezov, and M. F. Komarova (Inst. of Physics of Metals, Ukrainian Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1220-4(1957) Sept. (In Russian)

The coercive intensity, microhardness, and magnetic properties of Ni–Be alloys (1.9% Be, 1.25% Fe, 0.12% Al, 0.16% Cu, 0.15% Si and traces of Mg) were tested by aging at various lengths of time at 450, 500, 600, and 650°C. It is pointed out that the decomposition in Ni–Be follows two stages. In the first stage the alloy achieves its hardness maximum during the formation of enrichment zones, and in the second stage the coercive force increases up to 80 oersteds during the changes into β phase. (R.V.J.)

4213

STRUCTURE CHANGES AND PROPERTIES OF NICKEL SOLUTIONS IN HEAT TREATMENT. B. G. Livshits (Stalin Moscow Steel Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1225-31(1957) Sept. (In Russian)

The K-state in Nichrome, Permalloy, Invar, and alloyed molybdenum was studied by measuring the electrical resistance, dilatometry, hardness, magnetic resistance, etc. Diagrams of temperature effects on microstructure and electrical resistance are included. (R.V.J.)

4214

STRUCTURE OF Fe–Ni–Al ALLOYS IN THE HIGH-COERCIVE STATE. B. G. Livshits and V. S. Livov (Stalin Moscow Steel Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1232(1957) Sept.

The experiments pointed out that the intensity appearing in decomposition at 800 to 850°C affects the predecomposition state at 650 to 700°C. (R.V.J.)

4215

MAGNETIC INVESTIGATIONS OF ORDERING PROCESS IN Ni_3Mn BASE ALLOYS. B. G. Livshits and B. V. Molotilov (Stalin Moscow Steel Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1233(1957) Sept. (In Russian)

Effects of Mo on the ordering process of Ni_3Mn alloy were investigated. (R.V.J.)

4216

KINETICS OF SUPERSTRUCTURAL TRANSFORMATIONS IN THE Fe_3Al ALLOY. V. E. Rode (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 1234-8(1957) Sept. (In Russian)

Attempts were made to study the changes taking place in various physical parameters of Fe_3Al during the ordering process and simultaneously to determine the degree of ordering in the alloy using the intensities of superstructural lines on the alloy radiograms. (R.V.J.)

4217

ELASTIC MODULI AND TENSILE PROPERTIES OF TITANIUM–CARBON AND TITANIUM–ALUMINUM–CARBON ALLOYS. H. Brooks, G. I. Lewis, and J. I. M. Forsyth (Royal Aircraft Establishment, Farnborough). Metallurgia 56, 277-82(1957) Dec.

Although tensile tests and dynamic measurements on hot-rolled strip confirmed the beneficial effect of carbon additions on the tensile and shear moduli of titanium, carbon is considered unlikely to be used as a modulus-raising addition in commercial sheet alloys unless its effect on service temperature ductility can be lessened. Ternary alloys containing both carbon and aluminum in amounts sufficient to give a significant improvement in modulus were found to be brittle. (auth)

4218

THE PLUTONIUM–IRON SYSTEM. P. G. Mardon, H. R. Haines, J. H. Pearce, and M. B. Waldron (Atomic Energy Research Establishment, Harwell, Berks). J. Inst. Metals 86, 166-71(1957) Dec.

The equilibrium diagram for plutonium–iron alloys is given and is compared with one published by Russian investigators. The results verify the existence of: (a) the compounds Pu_6Fe and $PuFe_2$; (b) a low-melting-point eutectic between δ-plutonium and Pu_6Fe; and (c) a high-melting-point eutectic between $PuFe_2$ and γ-iron. An unusual type of eutectoid reaction has been observed in Pu-rich alloys in a region not shown in detail on the Russian diagram. (auth)

4219

A PRELIMINARY INVESTIGATION OF THE PLUTONIUM–THORIUM SYSTEM. D. M. Poole, G. K. Williamson, and J. A. C. Marples (Atomic Energy Research Establishment, Harwell, Berks). J. Inst. Metals 86, 172-6(1957) Dec.

X-ray, metallographic, thermal-analysis, and dilatometric studies have been used to investigate the Pu–Th phase diagram. Plutonium dissolves extensively in α-thorium, the maximum solubility being 48.5 at. % at 615°C. At ~ 32 at. % Th, a compound, ζ, occurs which is probably orthorhombic, with a = 9.820, b = 8.164, c = 6.681 A. This forms peritectically at 615°C from the (α-thorium + liquid) field, which extends over a large part of the diagram. The formation of the compound is sluggish on cooling and is normally preceded at 605°C by the eutectic at about 7 at. % Th between ε-plutonium, containing about 5 at. % Th, and the compound ζ; the remainder of the compound is then formed by a nonequilibrium peritectoid reaction at about 580°C between ε-plutonium and α-thorium. δ-Plutonium forms peritectoidally at 500°C by a reaction between ε-plutonium and the compound ζ. This reaction cannot be suppressed by quenching, and filings quenched from the ε field always show the x-ray-diffraction pattern of δ-plutonium. The maximum solubility of Th in δ-plutonium is about 5 at. % at 500°C. The large solubility of Pu in α-thorium is possibly associated with a considerable increase in the apparent atomic radius of the Pu atom; this large radius corresponds to a valency of 4 on Zachariasen's scheme, equal to that of Th; this, it is suggested, accounts for the wide stability range of the solution. (auth)

4220

LATTICE SPACINGS AND MELTING POINTS IN THE THORIUM–CERIUM SYSTEM. R. T. Weiner, W. E. Freeth, and G. V. Raynor (Univ. of Birmingham, Eng.). J. Inst. Metals 86, 185-8(1957) Dec.

The Th–Ce system has been studied by x-ray and micrographic methods. The system shows complete solid solution over the whole composition range at room temperature. The alloys are face-centered cubic, and an anomalous decrease in the lattice spacing of the Th-rich alloys with increasing Ce content is observed. It is suggested that this anomaly is caused by the transition of an electron normally in a $4f$ ionic state in Ce to a 5d bonding state. The solidus curve has been determined up to 1550°C. A high-temperature vacuum furnace and a gravity-quenching technique were used above 1200°C. The solidus was found to be a smooth unbroken curve. (auth)

4221

THE CONSTITUTION OF MAGNESIUM-RICH MAGNESIUM–ALUMINUM–CALCIUM ALLOYS. J. A. Catterall and R. J. Pleasance (National Physical Lab., Teddington, Middlesex). J. Inst. Metals 86, 189-92(1957) Dec.

Isothermal sections at 450, 370, and 290°C of the Mg–Al–Ca system have been constructed at compositions up to 6 wt. % Al and 1.6 wt. % Ca. The phases appearing in this range are α(Mg), Mg_2Ca, Al_2Ca, and $Mg_{17}Al_{12}$. (auth)

4222

U. S. PROGRESS IN TITANIUM DURING 1957. W. J. Harris, Jr. (National Research Council). J. Metals 10, 19-20(1958) Jan.

4223

TITANIUM IN BRITAIN AND THE CONTINENT. Eric Swainson (Imperial Chemical Industries, Ltd., Birmingham, Eng.). J. Metals 10, 21-4(1958) Jan.

4224

SOVIET TITANIUM RESEARCH AND PRODUCTION. John P. Nielsen (New York Univ.). J. Metals 10, 25-6 (1958) Jan.

4225

HIGH PURITY ELECTROLYTIC MAGNESIUM. F. J. Krenzke, J. W. Hays, and D. L. Spell (Dow Chemical Co., Freeport, Texas). J. Metals 10, 28-30(1958) Jan.

The production of high-purity magnesium by electrolytic processes is described. (W.L.H.)

4226

BEHAVIOUR OF METALS AT ELEVATED TEMPERATURES. LECTURES DELIVERED AT THE INSTITUTION

OF METALLURGISTS REFRESHER COURSE, 1956. New York, Philosophical Library, 1957. 126p.

4227

THE METALLURGY OF BERYLLIUM. ITS NUCLEAR APPLICATIONS. L. R. Williams and P. B. Eyre (U.K.A.E.A., I.G., Springfields). Nuclear Eng. 3, 9-18 (1958) Jan.

The favorable nuclear properties of beryllium could lead to its widespread application in reactor technology. This article discusses the chemical and metallurgical problems associated with the production and fabrication of the metal, and details the properties to be expected of the finished components. (auth)

4228

THE EXISTENCE OF A METASTABLE PHASE ISOMORPHOUS WITH THE STABLE PHASE OF A PURE METAL. J. H. O. Varley (Atomic Energy Research Establishment, Harwell, Berks). Phil. Mag. (8) 2, 384-8(1957) Mar.

A study of the factors controlling the coefficient of volume expansion of a pure metal, in a previous paper, has led to the conclusion that there are two isomorphous states, differing only in volume, of any given crystal structure. In this paper the relative stabilities of these phases is discussed and the possibility of isomorphic transformations is examined. A satisfactory description of a paradoxical phase change observed by Bridgman in the case of cesium under high pressures is achieved. An isomorphic transition observed in cerium appears to be another example of this type of phase change which, under suitable conditions imposed by the external variables, pressure and temperature, and possibly composition in the case of alloys, is possible in all metals. (auth)

4229

INVESTIGATION OF A SHOCK-INDUCED TRANSITION IN BISMUTH. Russel E. Duff and F. Stanley Minshall (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 1207-12(1957) Dec. 1.

The structure of the shock-wave system to be expected in a material which can undergo a polymorphic transition is discussed. It is shown that the slope of the coexistence line in the p-T plane for the transition can be determined from shock-wave measurements at a given initial temperature. Shock waves produced by high explosives were used to investigate the equation of state of Bi. An electrical contact technique was used to measure shock and free-surface velocities. The transition near 25 kilobars reported by Bridgman was observed but the transition pressure was about 3.5 kilobars higher than in static experiments. Other results indicated that recrystallization is a faster process than melting under shock conditions. Evidence suggests that the relaxation time for recrystallization in Bi at 42°C and 27 kilobars is less than 1 μsec. (auth)

PHYSICS

4230 AD-126029

Columbia Univ., New York.

STATISTICAL ANALYSIS OF FATIGUE. E. J. Gumbel. Mar. 1, 1957. 73p. Contract DA-30-069-ORD-1061. (CU-8-57-ORD-1061-IE).

The main aims of the statistical analysis of fatigue are the estimations of the minimum life and the endurance limit. The linear and the three parameter model for fatigue life lead to good agreements to the observations. In particular graph 10 may be considered as a convincing proof for the validity of the theory. Unfortunately, no reliable observations of frequencies of permanent survival based on a sufficiently large number of stresses are available. Therefore, no numerical examples for the estimation of the endurance limit, the construction of the total survivorship functions, and the general $(S,N)_1$ diagram can now be given. (auth)

4231 AERE-Inf/Bib-92(2nd Ed.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

HOMOPOLAR GENERATORS AND LIQUID METAL BRUSHES. A BIBLIOGRAPHY. M. Greenhill and N. Skeats. Sept. 1957. 10p.

4232 MLM-569

Mound Lab., Miamisburg, Ohio.

DIFFUSION OF POLONIUM THROUGH ALUMINUM, STAINLESS STEEL, AND BISMUTH. (Information Report). K. W. Foster and T. E. Eyles. July 1, 1951. Decl. Oct. 3, 1957. 17p. Contract AT-33-1-GEN-53. $3.30 (ph OTS); $2.40(mf OTS).

The diffusion coefficients for Po in Al, stainless steel, and Bi were measured roughly for problems connected with the production of Po^{208} in a cyclotron. The diffusion coefficient for Al was found to vary from approximately 3×10^{-13} square centimeters per second at room temperature to approximately 5×10^{-22} square centimeters per second at 500°C. For Armco 18-8 full-hard stainless steel, the coefficient was found to vary from approximately 1×10^{-22} square centimeters per second at 300°C to approximately 5×10^{-22} square centimeters per second at 750°C. The coefficient for Bi was found to be approximately 5×10^{-22} and 5×10^{-10} square centimeters per second at 150 and 200°C, respectively. This report describes briefly some of the mathematics of diffusion phenomena and how the coefficients are calculated from experimental data. The experimental method and sources of error are discussed. The data above are presented in detail in tabular form. Several typical autoradiographs of foils used in the experiments are included. A method of making thin Bi sheets is described, and pictures showing grain size and structure are attached. An appendix describes a correction necessary for alpha counters when thick sources are used. (auth)

4233 NP-6526

Pittsburgh. Univ.

CHARGE TRANSFER CROSS SECTIONS FOR PROTONS IN H_2. Technical Report No. 3 [on] CAPTURE-LOSS AND IONIZATION CROSS-SECTIONS OF IONS AND NEUTRAL PARTICLES. W. H. Kasner and T. M. Donahue. Nov. 1957. 93p. Contract Nonr-624(06).

Measurements of the cross sections for electron capture and loss by protons and hydrogen atoms in H_2 in the energy range from 2.4 to 33 Kev by a combination of new methods are presented. The results lie considerably below those of previous workers. The maximum value of σ_{10} per atom is 3.60×10^{-16} cm^2 for 9.49 Kev protons. Below this energy the cross section is very accurately proportional to the one third power of the energy. A discussion of the reasons for the disagreement with previous results is included. (auth)

4234 NYO-7238

Providence Coll., R. I.

THE STUDY OF GASEOUS NEGATIVE IONS FORMED BY ELECTRON IMPACT. Period Covered: December 1, 1955-November 30, 1956. Morton A. Fineman and David J. Karl. Nov. 30, 1956. 51p. Contract AT(30-1)-1670. $9.30(ph OTS); $3.60(mf OTS).

The Tate-Lozier retarding potential apparatus has been completed except for a few minor items. The various components of the apparatus were tested so that many of the instrument's idiosyncrasies have been uncovered.

Several electron impact experiments were performed with N in order to test the apparatus in complete operation. The results on forming N_2^+ ion seem satisfactory, but those on the formation of N^+ ion showed some discrepancies with the literature. The appearance potential for N^+ was low by 0.7 ev and the slope of the graph of the ion retarding potential versus electron energy which was 0.3, differed from the theoretical slope of 0.5. The monoenergetic electron beam technique was not employed to study N, however, some exploratory work soon after the electron impact investigation convinced us that the technique can be applied to our apparatus. Unfortunately, instead of directing efforts toward unravelling the causes of the above discrepancies, the high vacuum system which had imploded about that time had to be repaired. The instrument has now been repaired except for the replacing of the filament. A new press for supporting the filament was designed so that an additional cylindrical electrode to surround the filament and so to prevent charging of the glass can be included in the tube. It is believed that by using the monoenergetic electron beam technique, by obtaining a greater number of points for each run, and by operating with the new electrode future results should agree with those in the literature. (auth)

4235 RM-4(RAND)

RAND Corp., Santa Monica, Calif.

THERMODYNAMIC PROPERTIES OF METALS. Luis W. Alvarez. Feb. 18, 1947. 10p.

Thermodynamic properties of Ta, Mo, and W are tabulated. Crystal structures, phase studies, and other properties are reported for the following materials: Ta_2O_5, TaN, MoO_2, MoO_3, Mo_2N, WO_2, W_4O_{11}, $WO_{2.9}$, WO_3, and W_2N. Some thermodynamic properties are given for various fluorine compounds. (J.E.D.)

4236 SCTM-243-57(14)

Sandia Corp., Albuquerque, N. Mex.

THE DYNAMICS OF THE CYLINDER ESCAPEMENT. C. R. Steele. Nov. 21, 1957. 53p. Contract AT(29-1)-789. $9.30(ph OTS); $3.60(mf OTS).

A theoretical analysis was made of the physical behavior of the cylinder escapement. The differential equations of the system dynamics were developed in a generalized manner, so that they could be applied to almost any cylinder-escapement system. Because of the number of variables and the complexity of several of the differential equations, the entire analysis was programmed for a digital computer, a procedure which enables the design engineer to evaluate the theoretical timekeeping rate of any particular escapement in about 15 minutes. Thus, this work established a method of gaining considerable insight into the potentialities of the cylinder escapement. (auth)

4237 UCRL-5070

[California. Univ., [Livermore], Radiation Lab.].

MEASUREMENT OF HIGH TEMPERATURE. A Bibliography. G. R. Maynard. Sept. 17, 1957. 10p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

This bibliography is limited to book and journal references covering methods and instruments in general for measuring high temperatures. The search included only literature from 1950 to the present. Following sources were consulted: AEC Card Catalog, Engineering Index, and Physics Abstracts. (auth)

4238 AEC-tr-3098

ISOTOPIC EFFECTS IN THE ADSORPTION OF A GAS ON SOLIDS. P. Caldirola and G. Rossi. Translated from Nuovo cimento (10) 5, 1316-32(1957). 28p.

The isotopic effects that are manifested in the adsorption process of a gaseous mixture on a solid surface have been studied by using as a basis the Lennard-Jones theory of the interaction of atoms and molecules with solid surfaces. The general outlines of this theory are given and adapted to the problem under consideration. The formulas derived for a mixture of two generic isotopic species are applied to the particular case of the adsorption of He (He^3 and He^4) on LiF. It has been found that on the adsorbent surface the isotopic enrichment δ_{ads} under stationary conditions is always lower than the δ_k of Knudson which is characteristic of diffusion phenomenon, and that it approaches it with an increase in temperature. (auth)

4239 NP-tr-3

ON THE ETCHING DECOMPOSITION OF GLASSES BY IONIC BOMBARDMENT. G. V. Spivak, A. I. Krokhina, and L. V. Lazarjeva. Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 104, 579(1955). 3p.

An investigation was made of the surface of glasses after bombarding with a stream of positive neon and air ions at low pressure. (auth)

4240 NP-tr-6

ON THE INFLUENCE OF IMPURITIES ON THE RATE OF SELF DIFFUSION. M. E. Yanitskaya, A. A. Zhukhovitskii [Zhukhovitskij], and S. Z. Bokshtein. Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 112, 720-3 (1957). 6p.

4241

QUANTAL FACTORS IN THE JOULE-THOMSON COOLING OF HYDROGEN AND DEUTERIUM. S. D. Hamann (Univ. of Sydney). Australian J. Chem. 10, 373-80(1957) Nov.

This paper presents a theoretical analysis of the Joule-Thomson cooling of normal hydrogen and deuterium from an initial temperature of 64 °K. Below 70 atm the cooling is greater for H_2 than for D_2, but at higher pressures it is less. It is found that the difference at low pressures is due to the lower heat capacity of H_2, associated with the more quantized rotation of its molecules. The difference at high pressures is due to the less negative enthalpy of imperfection of H_2, and this in turn can be attributed to the higher zero-point energy for translational motion in the lighter isotope. Both differences can be accounted for quantitatively. (auth)

4242

THE MAGNETIC SUSCEPTIBILITY OF α AND β BRASS. B. G. Childs and J. Penfold (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 389-403(1957) Mar.

The magnetic susceptibility has been measured at 77 and 300°K of a series of copper–zinc alloys, ranging in composition from 0 to 47.6 atm. % zinc, and of one silver–cadmium alloy containing 30.5 atm. % cadmium. For the copper–zinc system the absolute susceptibility ranges from -0.085×10^{-6} emu/g for pure copper to -0.191×10^{-6} emu/g for 47.6% zinc. No significant difference was found between the values for a given alloy at the two temperatures of measurement. The significance of the results is discussed in relation to a theory recently proposed by Henry and Rogers. (auth)

4243

THEORY OF ANTIFERROMAGNETIC-FERROMAGNETIC TRANSITIONS IN DILUTE MAGNETIC ALLOYS AND IN THE RARE EARTHS. George W. Pratt, Jr. (Massachusetts Inst. of Tech., Lexington). Phys. Rev. 108, 1233-42(1957) Dec. 1.

In a previous paper a theory of direct exchange and superexchange coupling between d or f electrons and conduction electrons was given. This led to the possibility of an antiferromagnetic-ferromagnetic transition. A more complete treatment of this magnetic transition by way of

examining a particular case is given. Both the molecular-field theory and a cluster theory due to Oguchi are applied. Each leads to a magnetic transition and both predict that for all such transitions the ferromagnetic state must have a lower free energy at 0°K than the antiferromagnetic state. The transition is found to be of second order. Expressions are given for the parallel and perpendicular susceptibility in the neighborhood of the Néel point. A discussion is given showing how the direct exchange interaction with the conduction electrons makes a magnetic transition possible. A comparison is made between the theory given here and recent experimental results in Cu-Mn alloys. (auth)

4244

RADIATIVE CORRECTIONS TO THE GROUND-STATE ENERGY OF THE HELIUM ATOM. P. K. Kaibir and E. E. Salpeter (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 1256-63(1957) Dec. 1.

The radiative corrections of relative order $Z^2\alpha^3$ (absolute order $Z^4\alpha^3$ ry), corresponding to the Lamb shift terms arising from the nuclear Coulomb potential, and some of the $Z\alpha^3$ corrections, arising from radiative interactions between the electrons, are calculated for the ground-state energy of the helium atom. The $Z^2\alpha^3$ corrections are all calculated, but of the $Z\alpha^3$ corrections, which are expected to be much smaller, only those containing $\ln\alpha$ as a factor are retained—these may be estimated rather easily—and neglect the rest, regarding unity as being small compared to $\ln\alpha$. The $Z^2\alpha^3$ corrections require the calculation of an "average excitation energy" similar to the one defined by Bethe for the hydrogen atom. It is found that virtual transitions to states (1s) × (continuous p)^{1}P are the most important, and these are calculated using the momentum matrix-elements obtained by Huang, who used a six-parameter Hylleraas wave function for the ground state, and a product wave function with Z = 2 for the s-electron and Z = 1 for the p-electron (full screening), for the excited states. Transitions to states other than (1s) (continuous p)^{1}P are also considered, and the value of the "average excitation energy" for He is found to be 80.5 ± 10 ry, where the limits represent an estimate of the probable error of the result. The radiative correction to the ionization potential, which will be the difference of the corrections for the two-electron atom and the ion, is found to be -1.26 ± 0.2 cm^{-1}, where the error includes an estimation of the $Z\alpha^3$ terms which are not calculated. The corresponding radiative corrections are calculated, less accurately, also for Li^+, and the results generalized for He-like ions of higher Z by an extrapolation formula. (auth)

4245

PLASMA DIFFUSION IN A MAGNETIC FIELD. Marshall N. Rosenbluth (General Atomic Div. of General Dynamics, San Diego, Calif.) and A. N. Kaufman (Univ. of California, Livermore). Phys. Rev. 109, 1-5(1958) Jan. 1.

The equations governing the diffusion of a fully ionized plasma across a magnetic field are derived. It is assumed that macroscopic quantities vary slowly across an ion radius of gyration, and that the interparticle collision frequency is much less than the gyration frequency. The relevant transport coefficients—electrical resistivity, thermal conductivity, and thermoelectric coefficient—are derived. Some similarity solutions of the equations are found. (auth)

4246

CONDUCTIVITY OF PLASMAS TO MICROWAVES. Henry Margenau (Yale Univ., New Haven, Conn.). Phys. Rev. 109, 6-9(1958) Jan. 1.

A relation between the current-induced part of the distribution function (f_1) and the isotropic part (f_0), which was previously derived with limiting restrictions, is here shown to be valid at moderate electric fields for any form of f_0, e.g., for the case where an agency other than the passing microwaves determines it. The complex conductivity is then computed for a variety of functions f_0 (δ function, step function, Maxwellian distribution) and for different assumptions as to the dependence of the collision frequency on electron speed. The integrals encountered in this work are shown to be computable with good accuracy by means of a saddle-point procedure which is described. (auth)

4247

WAVES IN A PLASMA IN A MAGNETIC FIELD. Ira B. Bernstein (Princeton Univ., N. J.). Phys. Rev. 109, 10-21 (1958) Jan. 1.

The small oscillations of a fully ionized plasma, in which collisions are negligible, in a constant external magnetic field, is treated by the Laplace transform method. The full set of Maxwell equations is employed and the ion dynamics are included. Various limiting cases are considered. It is shown that self-excitation of waves around thermal equilibrium is impossible. It is also demonstrated that for longitudinal electron oscillations propagating perpendicular to the constant magnetic field, there are gaps in the spectrum of allowed frequencies at multiples of the electron gyration frequency, but zero Landau damping. These particular waves are also associated with a nonuniformity of convergence in the limit of vanishing magnetic field which phenomenon, however, is of no physical consequence. When the ion dynamics are included, two classes of low frequency oscillations are found, the existence of both of which has been predicted by the simple hydrodynamic theory, namely longitudinal ion waves, and transverse hydromagnetic waves. The well known results for the propagation of electromagnetic waves in an ionized atmosphere are also recovered, as well as the effects on such waves in various limiting cases of the magnetic field and particle motion. These calculations indicate that in many cases the transport equations are capable of yielding correct results, apart from such things as Landau damping, for a wide class of waves in a collision-free plasma. (auth)

4248

ENERGY BAND STRUCTURE OF LITHIUM BY A MODIFIED PLANE WAVE METHOD. E. Brown and J. A. Krumhansl (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 109, 30-5(1958) Jan. 1.

The one-electron Schrödinger equation is discussed for a periodic lattice. A variational procedure is applied to a set of trial functions consisting mainly of plane waves of low wave number. Rapid convergence is obtained by use of one or more auxiliary functions whose Fourier coefficients for high wave numbers approximate those of the correct eigenfunctions. The orthogonalized plane wave (OPW) method is a special case of this general method and the equivalence is shown. When applied to lithium the method gives a band structure in substantial agreement with that of cellular methods. (auth)

4249

K-EMISSION SPECTRUM OF METALLIC LITHIUM. D. E. Bedo and D. H. Tomboulian (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 109, 35-40(1958) Jan. 1.

The emission spectrum of an evaporated lithium target has been investigated in the spectral region extending from 60 to 600 A. The intensity distribution of the characteristic K emission band has been determined photometrically. Some features of the distribution $I(E)/\nu^2$ are as follows: the band has a maximum at 54.02 ev (229.50 A); the distribution drops to one-half of its maximum value on the high-energy side at 54.58 ev; and the decay in intensity from the peak to the high-energy limit of the band occurs in an energy interval of 1.18 ev. In agreement with the results of

earlier investigators, the band does not show a sharp high-energy cutoff. A second band, similar in shape and having a maximum at 82.83 ev, has been observed and is presently identified as a K satellite. (auth)

4250

EQUILIBRIUM CHARGES OF FISSION FRAGMENTS IN GASES. Clyde B. Fulmer and Bernard L. Cohen (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 94-9(1958) Jan. 1.

A magnetic analysis method was used to measure the equilibrium charges of median-mass light and heavy fission fragments in H_2, He, air, and A, and mass-97 fragments in He for wide ranges of fragment velocity and gas pressure. The data for the fragments in H_2, air, and A showed pressure effects on the equilibrium charge which yield estimates of the mean radiative lifetime of excited ionized fragments which agree within 25%, in contrast with previous estimates differing by a factor of 10. An experimental test of the Bohr assumption, than the equilibrium charge of a heavy ion is equal to the number of electrons whose orbital velocities are lower than the translational velocity of the ion, showed the assumption to be only a rough approximation. Measurements of equilibrium charge as a function of atomic number of the stopping gas agree with previous measurements. (auth)

4251

COULOMB EXCITATION OF Sb, Cs, AND Ba. L. W. Fagg (U. S. Naval Research Lab., Washington). Phys. Rev. 109, 100-4(1958) Jan. 1.

Coulomb excitation of several nuclei in the region between A = 123 and 137 has resulted in observation of the following gamma rays: Sb^{123}, 161 and 376 kev; Cs^{133}, 82, 163, 302, and 385 kev; Ba^{130}, 359 kev; Ba^{132}, 470 kev; Ba^{135}, 218 kev; and Ba^{137}, 281 kev. Values of reduced transition probability for excitation are given for most of the above gamma rays. In the case of Cs^{133}, absolute intensities and branching ratios are given for the gamma rays in the decay of the upper excited states. Level schemes are proposed based on coincidence studies and excitation curves. (auth)

4252

ELECTRICAL RESISTIVITY OF SEPARATED LITHIUM ISOTOPES. D. D. Snyder and D. J. Montgomery (Michigan State Univ., East Lansing). Phys. Rev. 109, 222-3(1958) Jan. 1.

Electrical resistivity measurements were made on the isotopes Li^6 and Li^7 to determine the dependence of the resistivity on atomic mass. (L.T.W.)

4253

RADIATIVE CHARGE TRANSFER FROM H ATOMS TO He^{2+} IONS. A. M. Arthurs and J. Hyslop (Queen's Univ. of Belfast). Proc. Phys. Soc. (London) A70, 849-56(1957) Dec.

The rate coefficient for radiative charge transfer from H atoms to He^{2+} ions is calculated at temperatures in the range 250 to 64,000°K. It is found to be almost independent of temperature and to be very high (the mean value being about 1.6×10^{-13} cm^3 sec^{-1}). As a subsidiary part of the work, earlier computations on the exact two center wave functions of the $1s\sigma$ and $2p\sigma$ states of HeH^{2+} and on the transition integral connecting these states are extended to internuclear separations up to 10 atomic units. (auth)

4254

THE ENERGY SPECTRUM OF CASCADE ELECTRONS IN LEAD. I. P. Ivanenko (Moscow State Univ.). Soviet Phys. JETP 5, 413-18(1957) Oct.

Recursion formulas have been obtained for the nth moment of the distribution function of a shower containing particles with energies above a prescribed value. The first two moments of the electron distribution function in lead have been calculated. The moment method has been applied to compute the energy spectrum of cascade electrons in lead. (auth)

4255

PHOTODISINTEGRATION OF NEON NUCLEI. A. P. Komar and I. P. Iavor (Academy of Sciences, USSR). Soviet Phys. JETP 5, 508(1957) Oct.

A natural mixture of Ne isotopes was irradiated with γ rays up to a maximum energy of 80 Mev. In a total of 719 cases the following reactions were observed: (γp), (γpn), $(\gamma 2p)$, $(\gamma 2\alpha)$, $(\gamma \alpha p)$, and $(\gamma 5\alpha)$. (L.T.W.)

4256

EMISSION MICROSCOPY WITH SECONDARY ELECTRONS (15 kev PRIMARY ELECTRONS). W. Bayh. Z. Physik 150, 10-15(1958). (In German)

4257

THE TEMPERATURE DEPENDENCE OF THE OPTICAL CONSTANT OF LITHIUM FLUORIDE AND SODIUM FLUORIDE IN THE INFRARED REGION. Manfred Klier. Z. Physik 150, 49-63(1958). (In German)

4258

MAGNETIC CHARACTERISTICS AND ELECTRON MICROSCOPIC STRUCTURE OF ELECTRODEPOSITED THIN TARGETS OF NICKEL–IRON ALLOYS. Ludwig Reimer. Z. Physik 150, 99-105(1958). (In German)

4259

THE PHYSICS OF FLOW THROUGH POROUS MEDIA. Adrian E. Scheidegger. New York, The MacMillan Company, 1957. 245p.

Of the pertinent information on the hydrodynamics in porous media, a selection was made. Emphasis is laid on the general physical aspects of the phenomena rather than on particular cases applicable, say, to special engineering problems. Of the many solutions available for some of the basic problems, only one is presented in each case. The theoretical aspects were stressed somewhat more than the experimental ones. A large part of the book is devoted to the flow of homogeneous, single phase fluids through porous media and only a smaller part to multiple phase flow. First, the properties of porous media and of fluids, by themselves, and then the interactions between the two, statics and dynamics, are discussed. Discussions are included on Darcy's Law, solutions of Darcy's Law, physical aspects of permeability, general flow equations, and multiple phase flow. An extensive bibliography is given. (M.H.R.)

Astrophysics

4260

INFLUENCE OF THE SURROUNDINGS ON NUCLEAR REACTIONS; ASTROPHYSICAL APPLICATIONS. M. E. Schatzman. J. phys. radium 18, 69S-70S(1957) Nov. (In French)

The influence of the surroundings on the following nuclear phenomena is considered: nuclear reactions between charged particles, with crossing of a potential barrier, α emission, fission and β capture. (tr-auth)

4261

SYNTHESIS OF THE ELEMENTS IN STARS. E. Margaret Burbidge, G. R. Burbidge, William A. Fowler, and F. Hoyle (California Inst. of Tech., Pasadena and Carnegie Inst. of Washington). Revs. Mod. Phys. 29, 547-650(1957) Oct.

Discussions are included on: the physical processes involved in stellar synthesis, their place of occurrence, and

the time-scales associated with them; H burning, He burning, the α process, and neutron production; the e, s, r, p, and x processes; variations in chemical compositions among stars, and their bearing on the various synthesizing processes; and general astrophysics. A collection of all the information relevant to the synthesis problem collected by the authors is given in an appendix. An extensive bibliography is included. (M.H.R.)

Cosmic Radiation

4262

ON THE ANALYSIS OF THE COSMIC RAY JETS. H. Huzita. Nuovo cimento (10) 6, 841-9(1957) Oct.

A new method for analyzing cosmic ray jets is presented which is independent of the angular fluctuations of secondary particles for each event. Two events are analyzed by this method and discussed. (auth)

4263

NEUTRON YIELD FUNCTIONS FOR THE NUCLEONIC COMPONENT OF COSMIC RADIATION. R. R. Brown (Univ. of California, Berkeley). Nuovo cimento (10) 6, 956-62(1957) Oct.

In view of recent proposed changes of cosmic ray geomagnetic co-ordinates and primary spectra, calculations have been made to determine if the yield function for the nucleonic component of cosmic radiation introduced by Fonger is in need of revision. As a result of these calculations, a modified form of Fonger's yield function is proposed for calculations with the revised spectra and coordinate system. The implications of this modification for the spectra of solar flare radiation are considered. (auth)

4264

ON THE ANGULAR DISTRIBUTION OF SECONDARY PARTICLES OF HIGH ENERGY JET SHOWERS. S. Hasegawa, J. Nishimura, and Y. Nishimura (Inst. for Nuclear Study Tanashi, Tokyo). Nuovo cimento (10) 6, 979-81(1957) Oct.

4265

THE 24 HOUR INTENSITY VARIATIONS OF THE PRIMARY COSMIC RAYS. A. M. Conforto and J. A. Simpson (Univ. of Chicago, Ill.). Nuovo cimento (10) 6, 1052-63 (1957) Nov.

The data from nucleonic component detectors (neutron intensity monitors) are analyzed for the amplitude and phase of maximum intensity of the 24 hr variation at the geomagnetic equator and at 48°N. The same analysis is performed on selected charged particle detectors. The analysis covers 1953-55, which includes the time of solar cycle (sunspot) minimum in 1954. During 1954 it is known that the 24 hr variation possesses an anomalous behavior. It is shown that during 1954 there is an interval of 9 months or more when the solar daily variation appears to undergo a progressive phase shift whose time of maximum lies in the range of 0800-1000 hr on a sidereal time scale. This anisotropy certainly exists in the radiation falling upon the atmosphere, and it is likely, although not proven, that the anisotropy prevails even outside the terrestrial field. The question of whether this sidereal effect is spurious or real is discussed in relationship to the recent results on the modulation of cosmic ray intensity within the solar system. (auth)

4266

A MULTIPLATE CLOUD CHAMBER STUDY OF UNSTABLE PARTICLES. M. Annis, N. F. Harmon, and R. D. Sard (Washington, Univ., St. Louis, Mo.). Nuovo cimento (10) 6, 1155-67(1957) Nov.

A multiplate cloud chamber was operated at mountain altitude under a penetrating shower selector. The distribution of scattering angles of penetrating secondaries is used to determine jointly the exponent γ of their differential momentum spectrum and the noise level, σ_1, of the chamber. γ is 2 to 2.5, and σ_1 is less than $0.8 \cdot 10^{-2}$ radians, corresponding to a maximum detectable momentum (standard error) of more than 2 Bev/c. Several unusual decays in flight have been found. In one, a charged V-decay gives rise to a photon, recognized by the electron shower it produces. The event is interpreted as $K_{\pi 2} \rightarrow \pi + \pi^0$, the π^0 decaying in its normal (2γ) mode. In another, a V^0-decay gives an interacting penetrating particle and a particle producing an electron shower in the first plate it strikes. The event is dynamically compatible with $\theta^0 \rightarrow \pi + \pi + 214$ Mev, but the charge exchange that must then be postulated is very improbable. A more likely interpretation is β decay: $K_\beta^0 \rightarrow \pi + e + ?^0$. From the observed energy release the neutral particle must be massless if K^0 has the same mass as the other K particles. Finally, a case is reported that appears to be a cascade decay of a neutral V into a charged one. The charged V decays into an interacting light particle, probably a π meson. The most likely interpretation in terms of presently known particles is $V^0 \rightarrow \Sigma^\pm + \pi^\mp$; $\Sigma^\pm + \pi^\mp + n$, with a mass of at least 1390 Mev ($Q_{\Sigma\pi} \geq 60$ Mev). (auth)

4267

HIGH-ALTITUDE INTENSITIES OF THE MEDIUM AND HEAVY COSMIC-RAY NUCLEI AND OF THE STAR-PRODUCING COMPONENT OVER A 25-HOUR INTERVAL. Raymond F. Missert (State Univ. of Iowa, Iowa City). Phys. Rev. 108, 1327-30(1957) Dec. 1.

Results are reported on a study of the hourly averaged values of intensity of medium and heavy cosmic-ray nuclei and of the star-producing component over a day and night interval, at an average atmospheric depth of 15 g/cm^2. The equipment was carried aloft by a Skyhook balloon on August 6, 1954 from Minneapolis, Minnesota (geomagnetic latitude 55°N). A large, thin-walled spherical pulse-ionization chamber served as the detecting instrument. Approximately 125 000 of these cosmic-ray events were recorded over the 25-hour flight interval; thus, statistical counting rate fluctuations were reduced substantially below those previously attained in this field. Analysis shows that approximately one-half of the counting rate at 15 g/cm^2 can be ascribed to the medium and heavy nuclei, the remainder being reasonably accounted for as arising from the star-producing component. No variation is observed in the hourly averaged counting rate of pulses of size greater than 6 Mev throughout the flight, to within the combined statistical and experimental uncertainties of ±4 to 6% during the daytime, and ±8 to 10% during the night. (auth)

4268

GEOMAGNETIC EFFECTS ON HEAVY PRIMARY COSMIC RADIATION AT 42°N. R. E. Danielson and P. S. Freier (Univ. of Minnesota, Minneapolis). Phys. Rev. 109, 151-7 (1958) Jan. 1.

The zenith and azimuthal angular distribution of primary cosmic rays with charges $Z \geq 5$ has been measured at Texas using horizontal emulsions with known orientation relative to the earth. The magnitude of the azimuthal asymmetry is consistent with Störmer theory down to a zenith angle of about 65° while for larger zenith angles the effect of the solid earth (shadow cone) is observed. The direction of the asymmetry seems to be consistent with the centered dipole approximation of the earth's magnetic field (north pole at 79°N and 70°W). The flux at the top of the atmosphere is 1.6 ± 0.3 particles/m^2 sec sterad for nuclei with $Z \geq 10$ and 4.8 ± 1.0 particles/m^2 sec sterad for CNOF nuclei. (auth)

4269
DIRECT OBSERVATION OF PERIODIC VARIATION OF PRIMARY COSMIC-RAY INTENSITY. M. A. Pomerantz, S. P. Agarwal, and V. R. Potnis (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 109, 224-5(1958) Jan. 1.

4270
SPECTRUM AND POSITIVE EXCESS OF THE HARD COMPONENT IN THE $(9.3 - 17) \times 10^9$ ev/c MOMENTUM RANGE AT AN ALTITUDE OF 3250 METERS. A. I. Alikhanian and A. O. Vaisenberg (Academy of Sciences, Armenian SSR). Soviet Phys. JETP 5, 349-51(1957) Oct.

The spectral distribution of the positive excess in the hard component was measured in the $(0.3 \text{ to } 17) \times 10^9$ ev/c momentum range. The measurements were performed on the large spectrograph of the Alagez Laboratory at an altitude of 3.25 km. (auth)

4271
MOMENTUM SPECTRUM OF THE COSMIC RADIATION AND THE POSITIVE EXCESS IN THE $(0.1-2.5) \times 10^9$ ev/c RANGE AT AN ALTITUDE OF 3250 m. A. O. Vaisenberg. Soviet Phys. JETP 5, 352-7(1957) Oct.

The spectrum of the hard component and the spectrum of unfiltered cosmic radiation have been measured at an altitude of 3.25 km with the aid of magnetic analysis. The spectral distribution of the positive excess was obtained, and the contributions of the proton and meson components to the magnitude of the excess have been evaluated. (auth)

4272
ENERGY SPECTRUM OF μ-MESONS IN EXTENSIVE ATMOSPHERIC COSMIC RAY SHOWERS. O. I. Dovzhenko, B. A. Nelepo, and S. I. Nikol'skii (Academy of Sciences, USSR). Soviet Phys. JETP 5, 391-3(1957) Oct.

The energy spectrum of μ mesons in extensive atmospheric showers of varying primary energy was studied in the energy range from 0.3 to 3.5 Bev. The measurements were carried out at mountain altitudes. It was found that in the aforementioned energy range the energy spectrum of μ mesons is independent of the energy of the primary particle which initiated the shower. The mean μ-meson energy decreases with the distance from the shower axis. (auth)

Crystallography and Crystal Structure

4273 NYO-6602
Carnegie Inst. of Tech., Pittsburgh.
AN X-RAY STUDY OF DISLOCATION ARRAYS. Lawrence Francois Vassamillet. Oct. 1, 1957. 90p. Contract AT(30-1)-Gen-359. $13.80(ph OTS); $4.80(mf OTS).

The dependence of line breadth of an x-ray line obtained by the Lambot technique is shown not to depend on sample thickness in the manner predicted by the equation relating line breadth to sample geometry. A possible reason for the difference in behavior is given. The presence of astigmatism of the focussed x-ray beam on line width is shown, and its effect on the measurement of dislocation densities in nearly perfect crystals is discussed. The generalized expression relating the dislocation density of a random array of dislocations to the angular misorientation of a particular set of lattice planes is derived as $\rho = \beta/(\overline{b_\phi^2}\ A)^{1/2}$, where ρ is the dislocation density, β is the angular misorientation, A is the area over which the misorientation is measured, and $(\overline{b_\phi^2})^{1/2}$ is the root-mean-square of the projection of the Burgers vectors on the lattice plane whose misorientation is measured. The dependence of broadening on the size of the diffracting area is found to satisfy the above relation in the case of a plastically deformed KCl crystal. The density obtained using this expression is consistent with densities estimated from the deformation process. The change of dislocation density with depth is measured on an aluminum single crystal deformed by machining. The average dislocation density is compared with that predicted by internal friction studies. (auth)

4274 NP-tr-8
THE ETCHING OF DIELECTRICS BY IONIC BOMBARDMENT. G. V. Spivak, A. I. Krokhina, T. V. Yavorskaya, and Yu. A. Durasova. Translated by S. J. Rothman from Doklady Akad. Nauk S.S.S.R. 114, 1001(1957). 3p.

An ionic etching technique was used to investigate the structure of quartz, Iceland spar, rock salt, Rochelle salt, amber, and plexiglass. Neon ions were used in the bombardment. The method is described and the resulting crystal structures are shown. (D.E.B.)

Electrical Discharge

4275
PINCHED DISCHARGE AND THERMONUCLEAR REACTORS. J. W. Gardner (English Electric Co., Ltd., Whetstone, Leics, Eng.). Nuovo cimento (10) 6, 1228-9 (1957) Nov.

A possible analytical approach to the study of one of the instabilities, namely the "kinking" of the pinched discharge, is indicated. It is suggested that the perturbation treatment of a toroidal field may prove a useful tool for the theoretical analysis of this instability, which obstructs the exploitation of the pinched discharge as the principle of the thermonuclear reactor. (M.H.R.)

4276
SOME QUESTIONS IN RELATIVISTIC HYDROMAGNETICS. Bruno Zumino (Stevens Inst. of Tech., Hoboken, N. J. and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 1116-21(1957) Dec. 1.

The basic equations describing the motion of an ideal relativistic fluid in the presence of electromagnetic fields are formulated both in their differential and in their integral form. From the integral equations shock conditions are derived. In the limit of weak shocks of the velocities of propagation of the various kinds of shocks and the discontinuities of the various physical quantities are calculated. (auth)

4277
THE THEORY OF QUASI-STABLE THERMONUCLEAR PROCESS. L. Biermann and A. Schlüter. Z. Naturforsch. 12a, 805-14(1957) Oct. (In German)

The conditions under which controlled thermonuclear processes can be used in a reactor are established. The discussion deals with the theoretical foundations and its applications to achieve and to maintain the necessary physical conditions. (auth)

4278
THE OSCILLATIONS OF A PLASMA CYLINDER IN AN EXTERNAL MAGNETIC FIELD. K. Körper. Z. Naturforsch. 12a, 815-21(1957) Oct. (In German)

The oscillations of a plasma cylinder of infinite length have been analyzed. The plasma is assumed to be homogeneous and to be exposed to a static homogeneous magnetic field in axial direction. There are two different types of oscillations. In one case the induced current is parallel to the magnetic field, and is therefore not influenced by it. In the other case where the induced current is perpendicular to the field two resonance frequencies exist. In the limit of small density and high magnetic field these are the gyrofrequencies of the ions and the electrons. The index of refraction for both types in the limit of small frequencies is that of the hydromagnetic waves. From the basic equations the energy conservation theorem is derived. Besides

the usual terms giving the electromagnetic radiation, Joule's losses, the electromagnetic energy density, it contains the kinetic energy of the ions and electrons of the plasma. (auth)

4279

THE GYRO-RELAXATION-EFFECT. A. Schlüter. Z. Naturforsch. 12a, 822-5(1957) Oct. (In German)

It is shown that a relaxation of the degrees of freedom of the motion along the lines of force of a magnetic field relative to those of the gyration around these lines always occurs if the strength of the magnetic fields changes with time or along the trajectories. This relaxation causes an increase in the temperature of a plasma, even if the magnetic field changes are periodic, and may represent a convenient heating mechanism for achieving extreme temperatures. (auth)

4280

SOLUTIONS OF THE MAGNETOHYDROSTATIC EQUATION OF AXIAL SYMMETRY WITH SURFACE CURRENTS. L. Biermann, K. Hain, K. Jörgens, and R. Lüst. Z. Naturforsch. 12a, 826-32(1957) Oct. (In German)

It is proposed to consider solutions of the magnetohydrostatic equation of axial symmetry in which the plasma is contained in a torus with circular cross-section. For mathematic simplification it is furthermore assumed, that the electric currents flow exclusively at the surface of the plasma. For the case, that these currents are assumed to be given, a method is outlined by which it is possible to calculate the exterior magnetic field which together with the magnetic field produced by the given currents, satisfies the boundary conditions at the surface. This procedure is carried through for the case of purely azimuthal electric currents, first by an approximate method, then by an exact method. To a first approximation it is sufficient to superpose an homogeneous field parallel to the axis of symmetry. For the case that the given currents are in a meridional planes, it is seen, that the boundary conditions can be satisfied only by the superposition of an additional current together with a suitable meridional exterior magnetic field. Therefore in the case of axial symmetry at least one azimuthal component of the electric current is necessary. (auth)

4281

STABILITY OF A PLASMA. K. Hain, R. Lüst, and A. Schlüter. Z. Naturforsch. 12a, 833-41(1957) Oct. (In German)

It is shown that the stability of hydromagnetic equilibrium as studied by the method of small perturbations is controlled by one differential equation of second order in time, if one neglects viscosity, electrical resistivity and thermal conductivity. Since the differential equation is self-adjoint some general theorems can be derived which hold for all configurations of hydromagnetic equilibrium. It is possible to show that the rates of growing are limited under certain conditions. Also some sufficient conditions of stability can be given. For a plasma cylinder, inside of which the magnetic field vanishes, the differential equations are solved explicitly and conditions for stability are given. Finally it is shown that the differential equation is also self-adjoint if the pressure is not isotropic. (auth)

4282

THE MOTION OF A CHARGED PARTICLE IN A MAGNETIC FIELD OF ROTATIONAL SYMMETRY. R. Lüst and A. Schlüter. Z. Naturforsch. 12a, 841-3(1957) Oct. (In German)

The motion of a charged particle in a magnetic field of rotational symmetry allows for a generalization of the law of conservation of angular momentum. From this conditions are derived, under which a particle will always stay within a finite volume. (auth)

4283

THE ADIABATIC INVARIANCE OF THE MAGNETIC MOMENT OF MOTION OF A CHARGED PARTICLE. F. Hertweck and A. Schlüter. Z. Naturforsch. 12a, 844-9 (1957) Oct. (In German)

The magnetic moment μ of the motion of a charged particle in a magnetic field is an approximate constant of motion in moderately varying magnetic fields. For the special case of a homogeneous time-dependent magnetic field, it is shown that the relative change in μ between two different states of constant field decreases at least exponentially in h/α if α/h tends to zero, where α represents the relative rate of change of the magnetic field and h denotes the gyro-frequency. (auth)

4284

CONDITIONS FOR MAGNETOHYDRODYNAMIC EQUILIBRIUM WITH AXIAL SYMMETRY. R. Lüst and A. Schlüter. Z. Naturforsch. 12a, 850-4(1957) Oct. (In German)

The conditions for magneto-hydrostatic equilibrium are studied in the case of axial symmetry. The magnetic field is divided into its meridional and its toroidal parts which are described by the scalar functions F and T respectively. It is shown that the gas pressure p and the functions F and T have to be functions of each other. Taking in particular p(F) and T(F) as known relations, a differential equation for F is derived. The cases in which this differential equation is linear are considered and explicitly solved if furthermore T(F) = const. In a special case, the magnetic lines of force are calculated numerically and shown in a figure. Some remarks on the stability are added. (auth)

4285

FORCE-FREE MAGNETIC FIELDS. II. A. Schlüter. Z. Naturforsch. 12a, 855-9(1957) Oct. (In German)

The general solution of the differential equation of force-free magnetic fields is given in the case of cylindrical symmetry. The energy density has to fulfil two inequalities; apart from this, it can be freely chosen as function of the distance from the axis of symmetry. The components of the field as well as the electric current density follow from it purely by differentiation. By explicitly constructing a three-parameter family of such force-free fields it is shown that the amount of momentum and of angular momentum transported by the field in the direction of the axis is not determined by the total magnetic and electric flux of the field. (auth)

4286

PARTIAL FUNCTION AND EFFECTIVE IONIZATION POTENTIAL IN THE INTERIOR OF A PLASMA. G. Ecker and W. Weizel. Z. Naturforsch. 12a, 859-60(1957) Oct. (In German)

Electrons

4287

AN EXPERIMENT FOR POLARIZATION OF FREE ELECTRONS. S. Yamaguchi (Scientific Research Inst., Tokyo). Nuovo cimento (10) 6, 977-8(1957) Oct.

Powder of a permanent magnet was attracted onto a substrate of magnet. An electron beam was split after passing through this ferromagnetic substance. (M.H.R.)

4288

THE POLARIZATION OF THE Co^{60} ELECTRONS. H. Bienlein, R. Fleischmann, and H. Wegener. Z. Physik 150, 80-6(1958). (In German)

Gases

4289
ON LOW-FREQUENCY OSCILLATIONS IN THE PLASMAS OF ELECTRONEGATIVE GASES. M. V. Koniukov (Tula State Pedagogical Inst.). Soviet Phys. JETP 5, 429-32 (1957) Oct.

The oscillations of ions in a plasma whose charged components are electrons, and positive and negative ions are considered. Two branches of low-frequency oscillations have been established whose frequencies depend differently on the concentration of the charged particles. (auth)

Instruments

Refer also to abstracts 4605, 4614, 4616, 4617, 4618, 4620, 4622, 4624, 4625, 4626, 4627, 4633, 4634, 4636, 4637, and 4641.

4290 AD-127866
Chance Vought Aircraft, Inc., Dallas.
EVALUATION OF SOME HIGH TEMPERATURE STRAIN GAGES UP TO 700°F. E. E. Day. Oct. 5, 1956. 56p. (TR-24495).

4291 HW-39926
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE DESIGN AND CONSTRUCTION OF AN IN-LINE PHOTOMETER SENSING UNIT. F. A. Scott and W. P. Van Meter. Nov. 17, 1955. Decl. Dec. 9, 1957. 30p. Contract W-31-109-Eng-52. $1.00(OTS).

The continuation of the work on the application of light photometry to the in-line determination of U is presented. It describes the present state of development at Hanford of the light photometer and the design of a modified photometer sensing unit which will permit an estimation of the turbidity present in the monitored stream. The U photometer sensing units were tested on streams in the Purex Hot Semi-Works. The application of these instruments on five process streams having widely different characteristics has been successful. (auth)

4292 LA-2152
Los Alamos Scientific Lab., N. Mex.
EQUIPMENT FOR EXPERIMENTS WITH ACTIVITIES HAVING HALF-LIVES IN THE RANGE FROM 10 μSEC TO 1 SEC. James Paul Glore. Sept. 1957. 31p. Contract W-7405-eng-36. $1.00(OTS).

The electronic circuits described were built for conducting experiments with radioactivities having half-lives in the 10 μsec to 1 sec range. The Model 10 beam shim pulser was designed for pulsing the beam of an electrostatic generator. It produces +550 volt pulses with rise and fall times of 1 μsec and an adjustable pulse length of 10 μsec to 1 sec into a capacitive load of 100 μμf. The Model 10 10-channel time delay analyzer has channel widths of 10 μsec to 1 sec and was built for determining half-lives of radioactivities in this time range. The Model 1 delay and gating circuit is used with a 100-channel pulse height analyzer to turn it on and off with a 1 μsec accuracy. The Model 2A gating unit incorporates delayed coincidence circuits which control the operation of the analyzer. (auth)

4293 NP-6535
Australia. Commonwealth X-Ray and Radium Lab., Melbourne.
MICRO-PIPETTE SAMPLING APPARATUS FOR RADIOACTIVE ASSAY. Technical Communication No. 40. T. H. Oddie. May 1950. 6p.

4294 NYO-7239
Providence Coll., R. I.
THE STUDY OF GASEOUS NEGATIVE IONS FORMED BY ELECTRON IMPACT. Period Covered: December 1, 1956–November 30, 1957. Morton A. Fineman and Americo W. Petrocelli. Nov. 30, 1957. 70p. Contract AT(30-1)-1670. $10.80(ph OTS); $3.90(mf OTS).

4295 RIB-25
David Sarnoff Research Center, Princeton, N. J.
DEVELOPMENT OF HIGH SPEED ELECTRON ACCELERATOR STRUCTURES. Quarterly Report No. 4 [for] May 1, 1957–July 31, 1957. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. Nov. 21, 1957. 45p. Contract AT(30-1)-1958. $7.80(ph OTS); $3.30(mf OTS).

Work was concentrated on the development of a high speed central electrode multiplier structure. This included the structure itself, an output electron optical system which may be used with it, and measurements of the transit time spread of this structure. Some time was spent on the development of circuitry required to establish the advantage of a coincidence circuit employing a trigger point which is a specified fraction of the pulse height rather than a fixed trigger voltage. The construction and properties of a focusing diagram for calculation of the time performance of the structure are discussed. Also included are discussions on a small linear multiplier structure and scintillation track imaging. (For preceding period see RIB-23.) (M.H.R.)

4296 SCTM-234-57(52)
Sandia Corp., Albuquerque, N. Mex.
ASKANIA PULSE GENERATOR. A. F. Huters. Sept. 19, 1957. 11p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The design of the transistorized Askania pulse generator is described. The purpose of this unit is to provide the Askania trigger units with two trains of pulses. The unit is entirely transistorized. All counting and logic functions are performed by circuitry built on plug-in cards which are mechanically keyed and color coded. (auth)

4297 SCTM-235-57(52)
Sandia Corp., Albuquerque, N. Mex.
MARK VI ASKANIA TRIGGER UNIT. A. F. Huters. Oct. 2, 1957. 16p. Contract AT-(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The design of the Mark VI Askania trigger unit is presented. The Mark VI unit was built to provide the Askania shutter and flash-lighting systems with operating current, derived from AC mains, upon the receipt of a command for operations in the form of a low-energy pulse transmitted over voice channels. The circuitry was designed to make use of EECO plug-in units wherever possible to reduce maintenance time and to allow persons unfamiliar with the equipment to make emergency repairs if necessary. Operation of the unit is based on a two-pulse system rather than the single-pulse system used previously. (auth)

4298 SCTM-336-57(14)
Sandia Corp., Albuquerque, N. Mex.
MEMORY-DIRECTED SYSTEMS. G. R. Bussey. Dec. 31, 1957. 7p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80 (mf OTS).

Automated data systems are fundamentally designed to accomplish services originally done by humans. The degree to which hardware can be replaced by memory is discussed from the systems viewpoint. It is urged that organizing functions be distinctly separated from doing functions in large-scale systems by utilization of gener-

alized computers which are micro-programmed. Sandia Corporation Technical Memorandum 337-57(14), A Memory-Directed Reading Machine, is a closely related exposition. (auth)

4299 WAPD-180
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. RELEASE OF FISSION GASES FROM IRRADIATED URANIUM DIOXIDE. PART I. APPARATUS FOR THE MEASUREMENT OF FISSION GAS RELEASE FROM FUEL MATERIALS DURING PILE IRRADIATION. J. M. Markowitz, R. C. Koch, and J. A. Roll. July 1957. 29p. Contract AT-11-1-GEN-14. $1.00(OTS).

An apparatus for the continuous measurement of the rate of escape of short-lived inert gas fission products from fuel materials during pile irradiation is described. Helium carrier gas is swept over a bare fuel element specimen placed in an in-pile furnace. Escaping fission products are carried into an out-of-pile gas handling system, where they are removed from the helium by selective adsorption on charcoal. An aliquot of the subsequently desorbed fission gas is analyzed by gamma-ray spectroscopy. The emanation of specific fission gases from the specimen surface is calculated from the measured gamma activity by applying corrections for counter efficiency, decay, decay scheme branching, and aliquot ratio. Details of design and construction are presented, and experimental operations and treatment of the data are described. (auth)

4300 AEC-tr-3103
PRODUCTION OF INSTRUMENTS FOR DETERMINATION OF AIR CONTAMINATION. N. A. Kudachkov. Translated from Gazovaya Prom. No. 5, 29(1956). 3p.

Three gas analyzers for air contamination studies have been tested, and results are briefly reported. The first instrument is a universal portable gas analyzer of the inspector type for rapid determination of H_2S, Cl_2, NH_3, gasoline, benzene, toluene, and oxides of nitrogen in the air. The second instrument is of the conductometric type for determination of CO, CO_2, and gasoline vapor in air by static and dynamic methods. The third instrument is a portable gas analyzer of the inspector type for determination of explosive concentrations of gasoline vapor (ethylated and nonethylated) in air. (J.E.D.)

4301 AEC-tr-3106
A DIFFUSION HYGROMETER. (Diffuzionnyi gigrometr.) L. F. Scerbakova. Translated by M. I. Weinreich from Meteorologi. i Gidrologi. 6, 49-52(1957). 10p.

The operation of a diffusion hygrometer is based on the diffusion of vapor and dry air through a thin porous plate which delimits air masses of different humidity. A diffusion hygrometer was constructed and tested using membranes made of various materials. (J.E.D.)

4302 AEC-tr-3108
A METHOD OF INTEGRAL MEASUREMENTS WITH EXTREMELY HIGH TIME CONSTANTS. G. Bartels and R. Steinert. Translated from Nachrichtentechnik 6, 500-2 (1956). 9p.

4303 AEC-tr-3115
A RADIOSONDE WITHOUT TRANSMITTER. (Radiozond Bez Peredátchika.) V. V. Kostarev. Translated by M. I. Weinreich from Met. Gidrol. No. 3, 83-6(1946). 9p.

Several experiments aiming at the technical feasibility of using a radiolocator for sounding the atmosphere, were carried out. The results and construction of these tests are given. The general theory and calculations connected with the devices are not presented. (M.H.R.)

4304
REMOTE HANDLING APPARATUS FOR USE WITH RADIOACTIVE MATERIAL. Justus Moll. Atomkern Energie 2, 482-5(1957) Nov.-Dec. (In German)

Isotopes

4305
THE INTERNATIONAL CONFERENCE ON THE USE OF RADIOISOTOPES IN SCIENTIFIC RESEARCH. W. Herbst. Atomkern Energie 2, 495-9(1957) Nov.-Dec. (In German)

4306
THE BETA SPECTRUM OF Pb^{210}. DIRECT TRANSITION TOWARD THE FUNDAMENTAL STATE OF Bi^{210}. Jean Tousset and Andre Moussa. Compt. rend. 245, 1617-20 (1957) Nov. 4. (In French)

Study with a double-focussing spectrometer of the β spectrum of Pb^{210} led to the fundamental state of Bi^{210}. The Bi^{210} and Pb^{210} spectra were separated by observing the growth of Bi^{210} in a freshly separated source. The spectrum obtained had a maximum energy of about 61 kev and intervened in 19 ± 4% of the disintegrations. (tr-auth)

4307
BETA-GAMMA POLARIZATION CORRELATION IN Au^{198}. J. Berthier, P. Debrunner, W. Kundig, and B. Zwahlen. Helv. Phys. Acta 30, 483-4(1957). (In German)

4308
ON THE TRANSMUTATION $Am^{241} \frac{\alpha}{\gamma} Np^{237}$. Salomon Rosenblum and Manuel Valadares (Permanent Magnet Lab. at Bellevue) and John Milsted (Atomic Energy Research Establishment, Harwell). J. phys. radium 18, 609-18(1957) Nov. (In French)

Several papers on α fine-structure and conversion electrons of $Am^{241} \frac{\alpha}{\gamma} Np^{237}$ have been published since 1948. An u up-to-date survey of all known contributions including our latest results is given. (auth)

4309
PHYSICAL BASIS FOR THE METHOD USING RADIOACTIVE ISOTOPES. HANDBOOK FOR PRACTICAL WORK. S. M. Raiskii and V. F. Smirnov. State Publishers of Technical-Theoretical Literature. Moscow, 1956. 335p.

The book is designed for the use of engineers, chemists, biologists, and other personnel not trained in nuclear physics, to aid them in their work with radioactive indicators. The handbook explains the physical basis of the method, describes the apparatus for recording radiations, analyzes conditions under which reliable measurements can be obtained, and cites the rules which must be obeyed in work using radioactive isotopes. (R.V.J.)

Isotope Separation

Refer also to abstract 4619.

4310 AEC-tr-3099
INFLUENCE OF ADSORPTION AND SURFACE MIGRATION ON ISOTOPIC SEPARATION IN THE DIFFUSION OF A GAS THROUGH A POROUS WALL. P. Caldirola and G. Rossi. Translated from Nuovo cimento (10) 5, 1374-6 (1957). 8p.

Mass Spectrography

4311

MASS SPECTROSCOPIC ATOMIC MASS DIFFERENCES. II. Henry E. Duckworth (McMaster Univ., Hamilton, Ontario, Can.). Revs. Mod. Phys. 29, 767-72(1957) Oct.

A brief description is given of the mass spectroscopic methods in current use for the determination of atomic masses. The agreement between atomic masses so-derived and those obtained by studying the energy balance in nuclear reactions is also lightly touched upon, with particular reference to the mass of C^{12}. Finally, a table is given of the atomic mass differences which have been obtained mass spectroscopically during the past three years. This table supplements (and occasionally amends) a similar table which appeared in the October, 1954, issue of this Journal. (auth)

Mathematics

4312 AERE-T/M-26

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME REMARKS ON THE FITTING OF THE BEST GAUSSIAN DISTRIBUTION TO A SET OF OBSERVATIONS. D. J. Behrens. [1949?]. 10p.

4313 CF-57-12-55

Oak Ridge National Lab., Tenn.

ORACLE CODES OF THE RESEARCH AND ANALYSIS SECTION OF THE REED DIVISION. Melvin Tobias. Dec. 13, 1957. 8p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

The Oracle codes prepared by the Research and Analysis Section of the Reactor Experimental Engineering Division are described in outline. All of the codes were devised with the intent of applying them to particular problems related to aqueous homogeneous reactors, but several of them may easily be extended to other applications. References are cited where available. (auth)

4314 LA-2120

Los Alamos Scientific Lab., N. Mex.

A PRACTICAL MANUAL ON THE MONTE CARLO METHOD FOR RANDOM WALK PROBLEMS. E. D. Cashwell, C. J. Everett, and O. W. Rechard. Jan. 1957. 228p. Contract W-7405-eng-36. $5.50(OTS).

This report is written to serve as a guide to those persons who, having no previous experience with Monte Carlo methods, wish to apply these methods to their own problems. Particular emphasis is given to techniques which are useful in dealing with problems concerned with the diffusion of particles (and gamma rays) in material media of some complexity, both from a geometrical and a nuclear standpoint. Included as an appendix are brief summaries of a variety of problems of the above-mentioned type to which the methods described have been applied successfully. (auth)

4315 MURA-380

Midwestern Universities Research Assn., Madison, Wis.

NON-HAMILTONIAN DYNAMICAL SYSTEMS. F. T. Cole. Dec. 22, 1957. 16p. Contract AT(11-1)-384. $3.30 (ph OTS); $2.40(mf OTS).

Transformations of variables in dynamical systems which are not in general Hamiltonian are discussed. The time dependence of the Jacobian of the transformation is found, as well as transformed equations of motion. A generalized method of the variation of constants is developed. (auth)

4316 ORNL-2364

Oak Ridge National Lab., Tenn.

FITTING LINEAR COMBINATIONS OF EXPONENTIALS TO HUMAN URANIUM-EXCRETION DATA. S. R. Bernard, B. R. Fish, J. R. Muir, and B. L. Harless. Jan. 10, 1958. 19p. Contract W-7405-eng-26. $0.75 (OTS).

Householder's modified Prony method, Garwood's method, and a modified least-squares approach for fitting linear combinations of exponentials were coded for the Oracle and applied to a set of synthetic data which approximately represents human uranium-excretion measurements. A brief description of the methods employed and a discussion of the results obtained are presented. (auth)

Measuring Instruments and Techniques

Refer also to abstracts 4612, 4613, and 4630.

4317 AERE-N/R-125

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY REPORT ON CRYSTAL COUNTERS. C. S. Bull and B. H. Flowers. Aug. 29, 1947. 9p.

The present state of the subject of conductivity pulses induced by radiation in crystalline materials is discussed and the results obtained to date are reviewed. A proposed program of study to be undertaken at Harwell is presented. (auth)

4318 ANL-5819

Argonne National Lab., Lemont, Ill.

DOSIMETRY IN THE ARGONNE HIGH-LEVEL GAMMA-IRRADIATION FACILITY. H. Gladys Swope. Jan. 1958. 12p. Contract W-31-109-eng-38. $0.50(OTS).

The oxidation of ferrous sulfate is used as the method of measurement of radiation intensity in the Argonne National Laboratory's High-Level-Gamma Food Irradiation Facility. The preparation and calibration of the dosimeters are described and illustrated photographically. (C.H.)

4319 CREL-741

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSISTORIZED RADIATION MONITORS. F. S. Goulding. Nov. 1957. 18p. (AECL-518).

Paper presented at I.R.E. Professional Group on Nuclear Science Meeting, New York, Oct. 31, 1957.

The advantages of transistors over vacuum tubes in radiation instruments have long been realized but a somewhat different approach to circuit design must be followed in developing transistor instruments, as compared with that used in vacuum tube circuits, and this seems to have discouraged many from developing such circuits. The design principles included in some instruments developed at Chalk River in the past two years are described in detail. Transistor high voltage supplies, ratemeters, and pulse amplifiers are discussed and two instruments using these elements are described. (auth)

4320 CRP-745 (Rpt:

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE STANDARDIZATION OF ELECTRON CAPTURING NUCLIDES: A PRELIMINARY STUDY. P. J. Campion and W. F. Merritt. Nov. 1957. 19p. (AECL-532).

A method for the standardization of electron capturing isotopes is described in which essentially all the x rays are absorbed in the sensitive volume of a 4π proportional counter operated at elevated pressures. The soft Auger

electrons are filtered out by a suitable absorber and the absolute disintegration rate is calculated from the fluorescence yield after making a correction for the x ray loss in the electron absorber. This correction is given graphically for a range of parameters applicable to this method. (auth)

4321 KAPL-1828

Knolls Atomic Power Lab., Schenectady, N. Y.

AN ALPHA COUNTER FOR UNIFORMITY MEASUREMENTS. F. A. White and J. C. Sheffield. July 1, 1957. 9p. Contract W-31-109-eng-52. $0.50(OTS).

An ionization-type α counter is used to measure the uniformity of thin coatings of α-emitting materials to ± 1% exclusive of statistical error. The (n,α) reaction allows the counter to be used for measuring the uniformity of B^{10} foils when a suitable neutron source is provided. (auth)

4322 NP-6528

Australia. Commonwealth X-Ray and Radium Lab., Melbourne.

THE CLINICAL REALIZATION OF THE ROENTGEN IN AUSTRALIA. Technical Communication No. 70. D. J. Stevens. 1957. 6p.

Calibration of x-ray equipment in clinical use in Australia is carried out using portable dosimeters which are calibrated as secondary standards in terms of the free-air chamber maintained at the Commonwealth X-Ray and Radium Laboratory. The calibration program is described in detail. (C.H.)

4323 USNRDL-TR-191

Naval Radiological Defense Lab., San Francisco.

RADIAC DOSAGE ALARM. E. J. Wesley, R. L. Hopton, and F. A. Rhoads. Oct. 10, 1957. 27p. [Project] NE 051-551.

A single instrument, the recycling alarm dosimeter, is proposed for the normal dose and doserate evaluation requirements of a work party entering a radiologically contaminated area. The discussion includes the capabilities and limitations of the recycling dosimeter as a measuring system and a specific review of a hybrid transistor-tube circuit for a field radiac instrument. The instrument discussed has a digital register and is capable of integrating and displaying 1000 r in steps of 0.1 r for doserates from 0.1 r/hr to beyond 500 r/hr. In addition, a plug connection is provided for operation of the unit as the sensing element of a remote monitoring station to doserates of 10,000 r/hr. (auth)

4324 WAPD-TM-92

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

LARGE COUNTING LOSSES IN NEUTRON DETECTION CHANNELS. D. R. Harris. Oct. 1957. 10p. Contract AT-11-1-GEN-14. $0.50(OTS).

Counting losses in a neutron detection channel are measured conventionally by the multiple neutron source technique or by use of a double pulse generator. Another technique, more useful in certain cases than the first two, was developed and applied to a study of large counting losses and channel saturation. In this technique, the neutron detector of the counting channel under investigation is placed near a reactor and the reactor's neutron flux is allowed to increase exponentially with time. Successive counts are obtained from the experimental channel and from several monitor channels of lower count rates and negligible count losses. Data from the monitor channels are used to establish the rate of neutron flux increase with time. The measured rate of increase is employed to extrapolate an expected pulse rate curve for the experimental channel from times when count losses are negligible to later times when count losses are large. The differences between "expected" and measured count rates represent count losses. The method is an extension of the multiple neutron source technique in which a reactor is used to provide a variable source. Limitations and advantages of the technique are discussed after presentation of the experimental data. (auth)

4325 YAEC-RD-3

Yankee Atomic Electric Co., Boston.

RADIATION MONITORING REPORT. John W. Lebourveau. Sept. 23, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

Radiation monitoring equipment was calibrated and measurements were made on background fluctuations and the concentration of activity in natural materials. (C.H.)

4326 AEC-tr-3104

USE OF PULSED IONIZATION CHAMBER AS AN α-RAY SPECTROMETER CONSTRUCTION AND OPERATION OF THE CHAMBER. B. A. Bochanov, A. A. Vorobev, and A. P. Komar. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1455-60(1956). 9p.

4327

MEASUREMENT OF THE SPECIFIC PRIMARY IONIZATION OF ELECTRONS BY THE WILSON CLOUD CHAMBER METHOD. Joseph Allewaert, Remy Van de Walle, and Julien Verhaeghe. Compt. rend. 245, 1611-14(1957) Nov. 4. (In French)

4328

USE OF CURVED NUCLEAR PHOTOGRAPHIC EMULSIONS. J. Heidmann. J. phys. radium 18, 625-8(1957) Nov. (In French)

4329

A TOTAL-ABSORPTION ČERENKOV COUNTER FOR PHOTONS OF ABOUT 100 Mev ENERGY. J. Moffatt and M. W. Stringfellow (Clarendon Lab., Oxford, Eng.). J. Sci. Instr. 35, 18-20(1958) Jan.

The counter uses a cylindrical crystal of thallous chloride 12 cm long and 9.3 cm in diameter viewed by a photomultiplier tube, and is capable of giving pulses of up to 3 v in height without serious departure from linearity. The pulse height resolution for 78 Mev photons is 34%, and both the mean pulse height and resolution remain constant to within 5% over an entrance aperture 5 cm in diameter. The performance of the counter is discussed in some detail, and it appears that the resolution is limited principally by strong absorption of ultra-violet light in the crystal. (auth)

4330

A GAS TARGET AND NUCLEAR PLATE CAMERA. D. L. Booth, R. S. Hill, F. V. Price, D. Roaf, and G. L. Salmon (Clarendon Lab., Oxford, Eng.). J. Sci. Instr. 35, 24-6 (1958) Jan.

A windowless gas target capable of maintaining a pressure of up to 2 mm of mercury was constructed to determine the differential cross-section of charged particle reactions. Targets of this type have been used to examine (d, p) and (d, α) reactions in the range 15 kev to 1 Mev. (auth)

4331

FOIL DEPRESSION FACTORS FOR INDIUM DISK DETECTORS. Tom L. Gallagher (Convair, Fort Worth, Texas). Nuclear Sci. and Eng. 3, 110-12(1958) Jan.

Measurements of the flux depression caused by In foils in the Argonne National Lab. Standard Pile were made. A plot of saturated activity per unit thickness versus thickness is shown for In foil diameters of 0.75 and 1.50 in. (M.H.R.)

4332

STATISTICAL THEORY OF THE COUNTING OF ALPHA PARTICLES EMITTED BY SUCCESSIVE DISINTEGRA-

TIONS OF RADIOELEMENTS. M. Huybrechts. Nuovo cimento (10) 6, 811-31(1957) Oct. (In French)

The distribution of the number of α particles registering in a time interval on a counter mounted on a radioactive source of any thickness was studied for the general case where the source containing the radioactive element undergoes successive disintegrations. The calculation of the cumulations shows that the distribution is asymptotically gaussian. A method of calculating the conditional probabilities for counting alpha particles emitted by these successive disintegrations is developed in the appendix. The results are applied to the uranium and thorium families in equilibrium, for a time interval of 30 days. (tr-auth)

4333

CORRELATION OF GAS BUBBLE CHAMBER RESULTS WITH GLASER'S THEORY. C. Henderson and G.Kalmus (Univ. Coll., London). Nuovo cimento (10) 6, 925-6(1957) Oct.

The boundaries of the sensitive region of a methane-propane gas bubble chamber were shown to approximate to lines of constant n, in the case of this chamber n = 2 and n = 6, where n is the parameter defined by Glaser's equation. (auth)

4334

ON THE IMPULSES PRODUCED BY COSMIC RAYS IN PHOTOMULTIPLIERS. U. Amaldi, Jr. Nuovo cimento (10) 6, 946-52(1957) Oct. (In Italian)

The pulses produced in a photomultipler (Dumont 6291) by the traversal of the fast ionizing particles of the cosmic radiation was studied by means of a coincidence arrangement, through careful analysis of the pulse height distributions obtained in various conditions. The contribution of the Čerenkov effect in the glass of the window has been clearly established through its directional properties. The average pulse height of a Čerenkov pulse is ~5 photoelectrons. An upper limit for the contribution of isotropic scintillation is evaluated, and the possible contribution of the mechanism of direct extraction of electrons from the photocathode and the dynodes is discussed. (auth)

4335

FADING OF ALPHA PARTICLE TRACKS IN ILFORD C2 PLATES. S. Deutsch and E. Picciotto. Nuovo cimento (10) 6, 953-5(1957) Oct. (In French)

The fading of α-particle tracks in Ilford C2 emulsions was studied. After irradiation by an alpha source, the photographic plates were stored in air, at various temperatures for a period of four months. They were then compared with a standard plate which had been developed immediately after irradiation. Amongst the plates stored at −35°C no particle track fading was noticed, neither was a diminution in the number of tracks. Amongst those plates stored at 4°C and at 15°C, the grain density of the particle tracks had lessened and respective losses of 38 and 72% in the number of tracks were noticed. (auth)

4336

INFLUENCE OF THE EFFECTIVE LENGTH AND DIAMETER OF THE CYLINDER ON THE CURVE PLATEAU OF GEIGER-MÜLLER COUNTERS WITH GLASS WALLS AND EXTERNAL GRAPHITE. D. Blanc. Nuovo cimento (10) 6, 974-6(1957) Oct. (In French)

4337

A NEW WILSON CHAMBER OF LARGE DIMENSIONS. E. Fiorini, R. Giacconi, and C. Succi. Nuovo cimento (10) 6, 963-73(1957) Oct. (In Italian)

A large Wilson cloud chamber with an internal volume of more than a cubic meter and an illuminated volume of 120 × 114 × 50 cm^3 is described. The chamber may contain several plates up to a total weight of some metric tons. The characteristics of the apparatus are of such a kind, that the chamber can be employed either in cosmic ray research or with accelerators. The chambers associated equipment was planned to work also with overcompression. (auth)

4338

THE LIQUID HELIUM BUBBLE CHAMBER AS ANALYZER OF PROTON POLARIZATION. G. Jona Lasinio and G. C. Moneti. Nuovo cimento (10) 6, 989-93(1957) Oct.

A method for analyzing polarized protons is suggested. By scattering the protons in a liquid Hé bubble chamber, the collimation of the beam is by no means necessary, the analysis of each event being performed independently from the scattering angle and energy. The advantages and disadvantages are discussed. (M.H.R.)

4339

DIFFUSION OF RADIOACTIVE ELEMENTS OF THE Th SERIES IN NUCLEAR EMULSIONS. N. Marongiu. Nuovo cimento (10) 6, 1102-5(1957) Nov. (In Italian)

A description is given of a new case of scattering of radioactive atoms in nuclear emulsions. The phenomenal characteristics of the case prove the particular importance of the plate's treatment in relation to migration of radioactive atoms of various kinds. (auth)

4340

A p, γ COINCIDENCE METHOD FOR THE MEASUREMENT OF π^0 PHOTOPRODUCTION. W. John and G. Stoppini (Univ. of Illinois, Urbana). Nuovo cimento (10) 6, 1206-10 (1957) Nov.

A method was developed to measure differential cross sections for photoproduction of neutral pions from hydrogen below 260 Mev incident photon energies. The recoil protons are detected in coincidence with one of the decay γ rays of the pion. The proton counter telescope utilizes a proportional gas counter as transmission counter. A lead glass Čerenkov counter detects the γ rays. A thin liquid hydrogen target with Mylar walls is used. Some cross sections measured at 90° in the center of mass are presented. (auth)

4341

SCINTILLATION RESPONSE OF CsI(Tl) CRYSTALS TO FISSION FRAGMENTS AND ENERGY VS RANGE IN VARIOUS MATERIALS FOR LIGHT AND HEAVY FISSION FRAGMENTS. Clyde B. Fulmer (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 1113-16(1957) Dec. 1.

A thin CsI(Tl) crystal was used as the phosphor of a scintillation detector of fission fragments. Light and heavy fragments from pile neutron fission of U^{235} were magnetically separated and scintillation pulse heights in CsI(Tl) crystals determined as a function of range in various gases and metals. The relationship between pulse height and fragment energy was found to be linear. Specific fluorescence of fission fragments in the crystal increases monotonically with specific energy loss. Energy vs range curves were obtained for median-mass light and heavy fragments in H_2, He, air, A, Al, Ni, and Au. (auth)

4342

DECAY TIMES OF FLUORESCENT SUBSTANCES EXCITED BY HIGH-ENERGY RADIATION. Hartmut Kallmann (New York Univ.) and George J. Brucker (Evans Signal Lab., Fort Monmouth, N. J.). Phys. Rev. 108, 1122-30 (1957) Dec. 1.

Decay times of fluorescent light emitted by organic solutions and by organic and inorganic solids when excited by high-energy radiation are determined under various experimental conditions. The pulse-height ratios for α-particle and electron excitations are also found. The

probabilities for radiative and nonradiative transitions of the light emitting molecule are estimated and compared with values obtained from absorption measurements. The time required for energy transfer is estimated. The ratio of pulse heights obtained under α-particle excitation to those obtained under electron excitation are found to be roughly the same for all organic solutions and solids despite wide variations in lifetime; also no difference in lifetime between α-particle and electron excitations is found. This is not explained by present theories. A new theory to explain these facts is outlined. (auth)

Mesons

4343 NP-6518

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas. ON THE CAPTURE OF NEGATIVE MUONS BY LIGHT NUCLEI. J. Leitre Lopes. July 1,1957. 21 p. (Notas de Física, Vol. III, No. 21).

The capture of negative muons by protons can be regarded as taking place as a result of a direct coupling or via the pi-meson field. An attempt is made to check whether the static, cut-off pseudovector coupling model of the pi-meson-nucleon interaction can give rise to predictions on the capture of muons by nuclei in agreement with experiment. Chew theory leads to a capture rate 20 times smaller than that predicted by the direct coupling theory. Accurate calculations can be made for the case of hydrogen, deuterium or helium, for which experimental information would be highly desirable. Comparison with the observational data for carbon, oxygen and silicium, based on the ideal gas model for nuclei, indicates that they are consistent with the direct coupling theory. Meson theory gives a capture rate about 20 times too small. (auth)

4344

PRODUCTION OF POSITIVE π-MESONS IN VARIOUS NUCLEI BY 660 Mev PROTONS. A. G. Meshkovskii, Iu. S. Pligin, Ia. Ia. Shalamov, and V. A. Shevanov. Soviet Phys. JETP 4, 842-6(1957) July.

The energy spectrum of π^+ mesons produced at 45° to the incident beam by 660-Mev protons incident on Li, Be, C, Al, and Cu was measured. The cross section $d\sigma/d\Omega$ for π^+ formation in these elements is calculated, and conclusions drawn from the fact that all the spectra are similar. The differential cross section $d^2\sigma/d\Omega dE$ for production of π^+ mesons was measured at 158 Mev in Ag and Pb. Conclusions are drawn about the dependence of the π^+ meson production cross section on atomic weight for elements between Li and Pb. For elements between Li and Al the dependence is given by $d\sigma/d\Omega = (1.17 \pm 0.05) A^{\frac{5}{3}}$. Considerably fewer π^+ mesons than indicated by this formula are produced in elements after Cu. (auth)

4345

PHENOMENOLOGICAL CONSIDERATION ON THE HYPER-FRAGMENTS. Y. Poc Kwon, J. Ôba, and T. Gotô (Osaka Univ., Japan). Nuovo cimento (10) 6, 832-40(1957) Oct.

On the basis of a simple model, the binding energy of Λ° in hyperfragments is calculated and the nature of Λ°-nucleon force is discussed. On the same basis the Z-spectrum of hyperfragments produced in nuclear emulsions is also considered. (auth)

4346

THE DIFFERENTIAL AND DIRECTIONAL POSITIVE EXCESS OF MESONS AT SEA LEVEL. U. Fasoli, I. Modena, E. Pohl, and J. Pohl-Rüling. Nuovo cimento (10) 6, 869-81 (1957) Oct.

Results are given of a period of observation of the intensity of positive and negative μ mesons arriving at zenithal angles of 15, 30, 45, and 60°. The interpretation of the experimental data which is given here indicates that the E-W symmetry is due solely to the horizontal component of the Earth's magnetic field, which introduces a difference in the path length in the atmosphere for the mesons of different sign. Particular consideration is given to the fact that the exponent γ which appears in the meson energy spectrum is dependent on the zenithal angle. (auth)

4347

LIFE TIME ESTIMATE OF Λ° AND θ° PARTICLES. C. Ballario, R. Bizzarri, B. Brunelli, A. De Marco, E. Di Capua, A. Michelini, G. C. Moneti, E. Zavattini, and A. Zichichi. Nuovo cimento (10) 6, 994-6(1957) Oct.

Among about 30,000 photographs taken with a multiplate cloud chamber triggered for penetrating showers, 115° events with a coplanar shower were found. The analysis of these events is discussed. (M.H.R.)

4348

PARITY NON CONSERVATION AND THE $\Delta I = \frac{1}{2}$ RULE IN HYPERON DECAYS. C. Ceolin. Nuovo cimento (10) 6, 1006-7(1957) Oct.

Measurements of the lifetime of the particles Σ^+ and Σ^- and the branching ratio of $\Sigma^+ \rightarrow P + \pi^\circ / \Sigma^+ \rightarrow N + \pi^+$ disagree with those calculated by the Gell-Mann and Pais rule. The degree of parity nonconservation necessary to reestablish agreement with the experimental data is calculated. (M.H.R.)

4349

DISPERSION RELATIONS FOR HEAVY MESON-NUCLEON INTERACTION IN A FIELD SOURCE THEORY. I. D. Amati and B. Vitale. Nuovo cimento (10) 6, 1013-26 (1957) Nov.

Dispersion relations for K-N and $\bar{K}$-N interactions are obtained in a fixed source approximation. The simultaneous presence of K and $\bar{K}$ in the heavy meson field is taken into account, as well as the interaction of the pion field with the barions. The dispersion relations for the forward scattering amplitudes are obtained without specifying the Hamiltonian in detail. The results are applied to the special cases of "scalar" and "pseudo-scalar" heavy mesons. For these special cases, a simpler method similar to that of Chew and Low is developed. Results are analyzed and compared formally to those obtained in previous work where rather stringent approximations were done. The neglect of $\bar{K}$ in K-N scattering (and in inverse) seems unjustifiable. The presence of the pion field is effective in the definition of the K-N-Λ and K-N-Σ renormalized coupling constants, and gives raise to unphysical regions in the dispersion integrals. (auth)

4350

THE BINDING ENERGY OF SIGMA HYPERONS WITH NUCLEONS. B. Ferrari and L. Fonda. Nuovo cimento (10) 6, 1027-33(1957) Nov.

The binding of Σ hyperons with single nucleons is discussed assuming that the interaction takes place either through pions, or K mesons or both. It appears that in order to obtain a bound system, the most reasonable assumption is to consider both the pion- and the K-forces. (auth)

4351

ON THE MEAN LIFE OF μ^--MESONS IN ELEMENTS OF MEDIUM AND HIGH ATOMIC NUMBER. A. Alberigi-Quaranta, F. Pieraccini, and D. Broadbent. Nuovo cimento (10) 6, 1084-1101(1957) Nov.

The mean life of μ mesons stopped in iron has been investigated by means of a new apparatus. The experimental arrangement for the determination of the mean life of μ^- in elements of mean and high atomic number is described.

The deflection of the trajectory of a cosmic ray μ-meson passing through two magnetized iron blocks (B = 1.5 Wb m^{-2}) indicates the sign of the incoming meson. The deflection is measured by an hodoscope of 90 Geiger counters. A fast syncroscope determines the interval of time between the arrival of the meson and its disappearance in the absorbers due either to capture by nuclei or to the normal process of decay. The error in the reading of the time intervals is $\sim 10^{-8}$ sec. The mean life of the meson in the element constituting the absorber is directly calculated from the distribution of the delays. The value for the mean life of the μ^--meson in iron was found to be $\tau = (16 \pm 1) \cdot 10^{-8}$ sec. (auth)

4352

THE EFFECT OF THE ANGULAR VARIATION OF INTENSITY ON SCATTERING DISTRIBUTIONS OF μ-MESONS UNDERGROUND AT A DEPTH OF 40 m w.e. J. E. Cousins, W. F. Nash, and A. J. Pointon (Univ. of Nottingham). Nuovo cimento (10) 6, 1113-21(1957) Nov.

The interpretation of experiments carried out underground to investigate the large angle scattering of μ mesons depends on the assumed form of the underground spectrum and the geometrical bias introduced by the counter selection system. The form of the angular variation of intensity at 40 m w.e. was obtained. The effect of introducing this into the calculation of the geometrical correction factors is discussed. It is shown that previous workers who assumed normal incidence of all particles underestimated the expected number of large angle scatters. (auth)

4353

ON THE Q-VALUES OF THE Λ^0 AND THE θ^0 AND ON THE ANOMALOUS V^0-DECAYS. C. D'Andlau, R. Armenteros, A. Astier, H. C. DeStaebler, B. P. Gregory, L. Leprince-Ringuet, F. Muller, C. Peyrou, and J. H. Tinlot. Nuovo cimento (10) 6, 1135-54(1957) Nov.

A study of 161 V^0-decays observed in the momentum chamber of the Ecole Polytechnique at the Pic du Midi has been made. These events correspond to a strict choice based on the measurability of the momenta of both secondaries (better than 10%). The main results are: No direct evidence for anomalous neutral hyperon decays. Upper limits (6 to 8%) can be placed on the existence of various hypothetical modes. The Q-values for the Λ^0-decay: $Q_{\Lambda^0} = (37.9 \pm 0.4)$ Mev. The direct identification of the π nature of both secondaries of the θ^0-decay-mode. The Q-value for θ^0-decay: $Q_{\theta^0} = (217 \pm 4)$ Mev. A direct proof of the non identity of the particles responsible for the θ^0-decay and the anomalous V^0-decays based on the significant difference between the number of slow and fast events of each category. (auth)

4354

PRODUCTION OF STRANGE PARTICLES BY 4.3 Gev π^- IN EMULSION. C. Besson, J. Crussard, V. Fouché, J. Hennessy, G. Kayas, V. R. Parikh, and G. Trilling. Nuovo cimento (10) 6, 1168-88(1957) Nov.

A large stack of emulsion was exposed in the 4.3 Bev π^- beam of the Berkeley Bevatron. 317 K^+ and 96 K^- stopping in the stack have been observed; 184 K^+ and 66 K^- have been followed back to an originating star made by a beam π^-. The origins of K^+ are larger than those of K^-, as far as the numbers of black and grey prongs are concerned, and the emission of the K^- is more concentrated in the forward direction than that of the K^+. Charged Σ of moderate energy were observed in the origin of K^+; their frequency is $0.17^{+0.12}_{-0.06}$ per star. The mean free paths for production of K^+ and K^- of energy < 150 Mev in emulsion are (4700 ± 1200) cm and (24000 ± 7000) cm respectively. The majority of the K^+ stopping in the stack are probably produced in secondary collisions in the nucleus of pions resulting from the first impact of the incoming π^-. A larger fraction of the K^- is probably produced in the first collision. Approximate values of the production cross sections of strange particles by the collisions of 4.3 Bev π^- with nucleons can be deduced from the study of suitably selected small origins of K^+ and K^-. The cross section for the production of K^+ is ~0.7 mb. For K^-, it is probably ≥0.3 mb. It thus appears that as the pion energy increases from 1 to 4 Bev, there is no pronounced increase in the total cross section for strange-particle production. The $K\bar{K}$ production becomes a substantial fraction of the total, and the direct hyperon production probably remains about constant or decreases. (auth)

4355

RADIATIVE BETA DECAY OF THE PION. J. C. Taylor (Imperial Coll. of Science and Tech., London). Nuovo cimento (10) 6, 1226-7(1957) Nov.

Theoretical estimates of the probability of the decay mode $\pi^+ \rightarrow e^+ + \nu + \gamma$ now definitely disagree with experiment. It is shown that the disagreement is removed if the pion-nucleon interaction is assumed to be pseudo-vector rather than pseudo-scalar. There are no reasons against this assumption except that the gradient coupling theory is not renormalizable. (M.H.R.)

4356

μ-MESON DECAY IN THE THEORY OF INDIVIDUAL MASS REVERSAL AND IN THE TWO COMPONENT THEORY OF NEUTRINO. H. Segawa (Fukui Univ.) and S. Hori (Kanazawa Univ.). Nuovo cimento (10) 6, 1230-1(1957) Nov.

The theory of individual mass reversal was previously proposed, based on the assumption that every existing interaction does not allow the measurement of signs of masses of all elementary particles. The theory predicts almost the same results for β- and π-μ decays as the two component neutrino theory. The muon emitted in π-μ decay undergoes complete polarization in this theory also, the only difference being that in contrast to the two component theory the muon can have either spirality right or left independently of the observed anisotropy in the β-decay experiments. Another difference between the theories is polarization of the emitted positron. (M.H.R.)

4357

SEARCH FOR MASS-500 PARTICLE AS K^+ DECAY PRODUCT. G. Harris, J. Orear, and S. Taylor (Columbia Univ., New York). Nuovo cimento (10) 6, 1232(1957) Nov.

If the mass-500 particle is a decay product of a known particle, the only possibilities for the parent are the K meson and the Ξ hyperon. The K-meson decay is energetically more favorable by at least 100 Mev. In a sample of 5000 K endings, no case of a mass-500 particle as a decay product was found. (M.H.R.)

4358

CAPTURE OF μ^- MESONS BY PROTONS. Kerson Huang and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.) and T. D. Lee (Columbia Univ., New York). Phys. Rev. 108, 1340-1(1957) Dec. 1.

By use of a two-component theory of the neutrino, the capture process and the radiative capture process of a μ^- by a proton is analyzed in some detail. (auth)

4359

POLARIZATION OF μ^+ MESONS FROM THE DECAY OF K^+ MESONS. Charles A. Coombes, Bruce Cork, William Galbraith, Glen R. Lambertson, and William A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 108, 1348-51 (1957) Dec. 1.

The angular distribution of positrons arising in the decay chain $K_{\mu 2} \rightarrow \mu^+ \rightarrow e^+$ was measured. It is concluded

that the μ mesons from $K_{\mu 2}$-meson decay are highly, if not completely, polarized, and the direction of polarization is the same as that occurring in $\pi \rightarrow \mu \rightarrow e$ decay. This result strongly suggests that the spin of the K meson, like that of the π, is zero. It is noted that the observed direction of polarization is opposite to that predicted by the "attribute" scheme for the fundamental particles. (M.H.R.)

4360

NEGATIVE PION SCATTERING AND THE DISPERSION RELATIONS. M. H. Zaidi and E. L. Lomon (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 1352-3(1957) Dec. 1.

The forward scattering dispersion relations have been used to analyze the scattering of negative pions on protons. Since the results were a poor fit, the integrals S_- over total cross sections that appear in the dispersion relation were recalculated. The results proved to be very sensitive to the chosen energy dependence of the total cross section, due to the strong dependence of the integral on the derivative of the cross section with respect to energy. Two curves of the cross section versus energy are presented which correspond adequately to the data. One of them gives forward scattering similar to previous results, the other does not significantly contradict the dispersion relations or charge independence. The possibility of distinguishing between the curves by re-examining the 100-Mev region is suggested. (M.H.R.)

4361

DEMONSTRATION OF PARITY NONCONSERVATION IN HYPERON DECAY. F. Eisler, R. Plano, et al. (Columbia Univ., New York). Phys. Rev. 108, 1353-5(1957) Dec. 1.

The question of nonconservation of parity in processes not involving neutrinos is studied for the case of Λ^0 decay into pion and proton. The results show a very large, statistically well established anisotropy for the Λ^0, clearly demonstrating parity violation in the decay. A lower bound on the anistropy coefficient is found to be $|\alpha| \geq 0.67 \pm 0.13$. (M.H.R.)

4362

SMALL-ANGLE PHOTOPRODUCTION OF POSITIVE PIONS FROM HYDROGEN. J. H. Malmberg and C. S. Robinson (Univ. of Illinois, Urbana). Phys. Rev. 109, 158-65(1958) Jan. 1.

The angular distribution of π^+ mesons produced in hydrogen by 225-Mev photons has been measured in the small-angle region. The mesons were produced in a liquid hydrogen target placed in the x-ray beam of the 300-Mev betatron. A focusing magnet was used to select mesons of the desired momentum. The large electron pair background was avoided by use of a very short x-ray pulse and a counter system which operated only after the pulse, counting the decays of μ^+ mesons. Points have been obtained at center-of-mass angles of 10, 15, 20, 30, 45, 60, and 90 degrees. The observed angular distribution cannot be fitted by a quadratic in $\cos\theta^*$, but is well fitted by the cross section calculated from the field theory of Chew, Goldberger, Low and Nambu. (auth)

4363

OBSERVATION AND ANALYSIS OF K^- INTERACTIONS. J. Hornbostel and G. T. Zorn (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 165-82(1958) Jan. 1.

In nuclear emulsions, 289 K^- mesons were observed. The mass and lifetime of K^- mesons is the same as that of K^+ mesons. The K^- mean free path in nuclear emulsion is geometric. Charge-exchange scattering and inelastic K^--nucleus scattering are rare. Positive hyperons are emitted in 8% of K^- capture stars, negative hyperons in about 9%, hyperfragments in 5%. It is estimated that a Λ^0 is trapped without production of a visible hyperfragment in an additional 8%. A K^- is captured by one nucleon with formation of a Σ hyperon and a pion in about 0.77 of the cases, with creation of a Λ^0 and a pion in approximately 0.18 of the events. Capture by two nucleons occurs in roughly 0.05 of the cases. From a comparison of production and emission frequencies of Σ hyperons it is concluded that an attractive nuclear potential for Σ hyperons must be less than 20 Mev. Limits for the mean free paths for ordinary scattering, for charge-exchange scattering, and for absorption of Σ hyperons in nuclear matter are given. The trapping of Λ^0 hyperons in nuclei is discussed. (auth)

4364

DECAY OF THE NEUTRAL π MESON. Jeremy Bernstein and Kenneth A. Johnson (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 189-92(1958) Jan. 1.

The possibilities of detecting the parity of the π^0 meson by electromagnetic experiments involving the decay γ rays are discussed. It is shown that no experiment can be performed which distinguishes scalar and pseudoscalar decays unless azimuthal angular correlations are measured, assuming that the π^0 decays at rest. As an example, the total coincidence Compton scattering cross section from polarized electron targets is calculated explicitly and shown to be identical for the scalar, pseudoscalar, and parity-nonconserving decay. (auth)

4365

RADIATIVE MESON-NUCLEON SCATTERING. R. E. Cutkosky (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 109, 209-17(1958) Jan. 1.

In this paper the static-source model of the pion-nucleon interaction is applied to the problem of the bremsstrahlung emitted in pion-nucleon scattering. It is shown that the matrix element for radiative meson scattering can be expressed in terms of other experimentally determined quantities, such as the matrix element for elastic scattering, provided the general static-source model is valid. Therefore, comparison of experimental results with those predicted by the present investigation will indicate the extent to which this simple model is valid, and suggest the refinements which are needed. (auth)

4366

CONCERNING THE LIFETIME OF THE TWO FORMS OF THE π^0 MESON. A. V. Romankevich (Moscow State Univ.). Soviet Phys. JETP 5, 509(1957) Oct.

Results are presented of calculations of the lifetime for the two forms of π^0 meson, $\pi^0(P + \overline{P})$ and $\pi^0(N + \overline{N})$, where P denotes proton, N neutron, $\overline{P}$ antiproton, and $\overline{N}$ antineutron. (L.T.W.)

4367

ON THE DERIVATION OF THE LOW EQUATION IN THE THEORY OF MESON SCATTERING. A. M. Brodskii (Moscow State Univ.). Soviet Phys. JETP 5, 509-11(1957) Oct.

A new method is given of deriving Low's equations, the analysis of which is very important in discussions pertaining to the theory of scattering of mesons by nucleons. It is shown that they may be written in a form where the concrete type of interaction enters in a simple way through a nonhomogeneous term. (L.T.W.)

4368

POSSIBLE CORRELATIONS IN π-μ-e DECAY. L. Okun' and A. Rudik. Soviet Phys. JETP 5, 520-1(1957) Oct.

If parity is violated in π-μ-e decay, there must be correlations between the orientations of the momenta of the μ mesons and the electrons. The results of calculations of such correlations are presented when parity is violated in both the $\rightarrow \mu +$ decay and the $\mu \rightarrow e + 2$ decay. (L.T.W.)

Molecular Properties

4369

THE DIFFERENCE IN THE INTERMOLECULAR FORCES OF H_2O and D_2O. E. Whalley (National Research Council, Ottawa, Can.). Trans. Faraday Soc. 53, 1578-85(1957) Dec.

The lattice energy of a compound at 0°K can be obtained from the heat of sublimation at 0°K, the zero-point energies due to the various intermolecular vibrations, and the difference between the crystal and the gas in the intramolecular zero-point energies. The difference in the lattice energies of isotopic molecules which have the same crystal structure is a good measure of the difference in their intermolecular forces. The lattice energy of H_2O and the difference in lattice energies of H_2O and D_2O have been calculated from calorimetric and spectroscopic data. The lattice energy of D_2O at 0°K is higher than that of H_2O by 1.27 ± 0.6 kJ mole^{-1}. The difference is presumably due to the different intermolecular forces consequent on the anharmonic zero-point intramolecular vibrations, and the difference of dipole moments is probably the major contribution. This is the first clear evidence that isotopic molecules may have appreciably different intermolecular forces. The lattice energy of ice at 0°K is higher than is usually assumed because of the difference of zero-point energies between the solid and the vapor and it amounts to 56.0×0.7 kJ mole^{-1}. Most of the assigned error is caused by the uncertainties in the distribution of intermolecular rotational frequencies. (auth)

Neutrons

4370 AD-125132

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. A STUDY OF THE TRANSMISSION OF FAST NEUTRONS THROUGH NON-HYDROGENOUS MATERIAL BY APPLICATION OF THE FERMI AGE THEORY (thesis). Raymond Harry Lessig. Mar. 1957. 39p.

The validity of Fermi Age calculations applied to a source of fast neutrons surrounded by a finite medium of shielding material was determined. The materials used, of varying thicknesses, were Al, Fe, and Pb arranged in a spherical geometry surrounding a Po–Be source. The flux is calculated from the slowing down density which is obtained from the solution of the Fermi Age equation for a point source in an infinite medium. A comparison of calculated doses with experimentally determined doses shows that the Fermi Age theory results are not consistent with the experimental results at one to five inches distance from the source. In view of the basic assumptions inherent in the Fermi Age theory this was not unexpected; however, it was hoped that the errors would be consistent, or less significant. Similiar calculations made at 26 to 32 inches distance from the source resulted in better agreement with experimental predictions. Since Fermi Age is not applicable close to the source, recourse to the Monte Carlo method or Spencer-Fano "moments" method must be made. (auth)

4371

THE THERMAL NEUTRON SPECTRUM IN A DIFFUSING MEDIUM. H. Hurwitz, Jr. and M. S. Nelkin (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 3, 1-10(1958) Jan.

The energy-dependent thermal diffusion equation is considered in a region free of external sources. Two cases of experimental interest are calculated. The first of these is the steady-state condition where an eigenvalue problem for the thermal diffusion length is obtained. The associated eigenfunction is the neutron spectrum. The second case, which is mathematically identical to the first, is the exponential decay in time of the thermal flux in a pulsed source experiment. The neutron leakage is assumed to be describable by a single eigenvalue for the buckling. In this case the eigenvalue is the decay constant of the flux. When the ratio of absorption cross section to transport mean free path decreases with energy in the thermal region, the first case will give a "diffusion hardening," and the second case a "diffusion cooling" of the neutron spectrum compared to a Maxwellian distribution at the moderator temperature. These effects are investigated quantitatively for the model of a heavy gaseous moderator. (auth)

4372

FAST NEUTRON SCATTERING FROM THICK SLABS. T. D. Strickler, H. E. Gilbert, and J. A. Auxier (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 3, 11-18 (1958) Jan.

An experimental evaluation has been made of the Po-Be fast neutron absorbed dose albedos for concrete, water, and Al. By assuming neutrons are scattered isotropically in the center of mass system, a good fit to Plesset's albedo theory was obtained. The values for the albedos were found to be 0.32 for Al and concrete, and 0.092 for water. (auth)

4373

SOME CHARACTERISTICS OF THE THERMAL NEUTRON SCATTERING PROBABILITY. R. K. Osborn (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 3, 29-37 (1958) Jan.

An explicit form for the function representing the probability that a neutron with velocity v' shall be scattered into an element of volume in velocity space $d^3\nu$ about v, by elastic collisions with atoms of arbitrary mass number A in a Maxwell-Boltzmann distribution characterized by a temperature T, is derived. Analytical representations of this probability are presented for scattering cross sections which are either independent of relative speed or exhibit a Gaussian dependence. The scattering probability resulting from the former assumption is examined in some detail, and then employed in a calculation of the mean energy change per collision. (auth)

4374

NEUTRON SELF-SHIELDING IN A SIMPLE PLANE LATTICE. Joel Bengston (Univ. of California, Livermore). Nuclear Sci. and Eng. 3, 71-6(1958) Jan.

A generalization of the Serber-Wilson method was used to derive an expression for the one neutron group self-shielding factor for an absorbing material alternating with a pure moderator and scatterer in a simple plane lattice. The formula was found as accurate as a considerably more complicated double spherical harmonic calculation. (auth)

4375

TRANSFER PROBLEMS AND THE RECIPROCITY PRINCIPLE. K. M. Case (General Dynamics Corp., San Diego, Calif. and Inst. for Advanced Study, Princeton, N. J.). Revs. Mod. Phys. 29, 651-63(1957) Oct.

It is shown that the radiative transfer theorems are the consequences of a simple identity. A uniqueness theorem essential to later arguments is derived. Various results which have been called "Reciprocity Principles" are obtained as special cases. In plane problems, Chandrasekhar's equations for the reflection function for a half-space are derived. These equations are used to obtain the Green's function for one velocity neutron diffusion in the same geometry. A specific reciprocity result is used to obtain the Green's function for two adjacent half-spaces. Chandrasekhar's equations for a slab are obtained as another specialization of the general reciprocity identity together with certain invariance considerations. (M.H.R.)

Nuclear Physics

4376 NP-6505

California. Univ., Berkeley.

INTERACTION OF ANTIPROTONS WITH COMPLEX NUCLEI. Technical Report No. 9. A. E. Glassgold. [1957]. 26p. Contract DA-04-200-ord-171.

The large reaction cross sections observed for antiproton collisions with complex nuclei may be understood in terms of strong absorption in the diffuse surface of the nucleus. Large values for the real part of the potential are not required. The elastic scattering of antiprotons is also discussed. (auth)

4377 UK/C/5/1

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

U.K./CANADA CONFERENCE. NUCLEAR DATA SESSION: 5—Pu^{239}, U^{235}, U^{233}—H_2O ASSEMBLIES (ZETR). K. C. Hines. [1956]. 5p.

Preliminary results of two-group calculations on the ZETR critical assemblies are presented. The method of approximate separation of the variables has been used throughout. Assuming best known values for the nuclear cross sections an attempt has been made to fit the experimental critical heights by varying the square of the slowing down length in water (L_s^2). For all three isotopes it has been found that reasonable agreement with experimental results can be obtained by a choice of 25 for L_s^2 in water, in the case of the more concentrated solutions. As the concentration of the fissile material decreases this agreement becomes much less satisfactory. It is shown that the calculations are much more reliable for the concentrated solutions than for the dilute solutions. (auth)

4378

SIMPLIFIED APPROACH TO SPIN IN DIRAC THEORY. H. Mendlowitz (National Bureau of Standards, Washington). Am. J. Phys. 26, 17-24(1958) Jan.

The usual definition of spin in the Dirac theory brings about peculiar results which one finds difficult to visualize from an intuitive standpoint. An approach to this problem utilizing the framework of the Foldy-Wouthuysen representation is suggested. Applications to the description of polarization of beams and scattering experiments are discussed. (auth)

4379

CAUSAL INTERPRETATION OF THE THEORY OF THE HYDROGEN ATOM USING THE HYDRODYNAMIC REPRESENTATION OF THE PAULI EQUATION. Pierre Hillion. Compt. rend. 245, 1595-7(1957) Nov. 4. (In French)

4380

CORPUSCULAR REPRESENTATION OF THE VECTOR FIELD, AND COMPARISON WITH THE FIELD OF MAXIMUM SPIN 1 OF THE FUSION THEORY. K. H. Tzou. J. phys. radium 18, 619-24(1957) Nov. (In French)

The general vector field is formulated in a matrix representation with a first-order wave equation. It is then shown explicitly how its two spin states 1 and 0 are mixed together. On the other hand, the general vector field obeys an algebraic law which is different from that of the irreducible fields of spin 1 and 0, though these fields are just the two spin components of the general vector field. This algebra constitutes therefore a new way in the formulation of a general mixed theory of the spins 1 and 0. Finally, a comparison is made between the general vector field and the field of maximum spin 1 of the fusion theory as concerning their internal structure with regard to spin states. (auth)

4381

NON LINEAR ELECTROMAGNETISM AND PHOTONS IN THE FUNCTIONAL THEORY OF PARTICLES. Florence Aeschlimann and Jean-Louis Destouches. J. phys. radium 18, 632-7(1957) Nov. (In French)

It is shown that Mie's or Born's equations of non linear electromagnetism are obtained from the non linear equations of the photon (functional theory), by means of linear combinations of these equations-defined by the fundamental operators of the Louis de Broglie photon. The magnetic and electric fields are defined exactly as in Louis de Broglie's theory of photon whereas the inductions are defined by other linear terms according to the second definitions of the fields by Louis de Broglie. Only the polarizations and the expressions deriving from them are expressed by means of non linear terms. In this way a microphysical theory can be constructed, which unifies Louis de Broglie's theory of the photon and Mie's or Born's non linear electromagnetism. (auth)

4382

EXPERIMENTS WITH SPIN TEMPERATURE. A. Abragam and W. G. Procter. J. phys. radium 18, 43S-48(1957) Nov. (In French)

Some experiments with nuclear calorimetry are described which consisted of studying the variation in polarization produced by a thermic mixture of spin systems of two nuclear species in the same sample. (T.R.H.)

4383

NON-LOCAL SEPARABLE INTERACTION AND COLLISION MATRIX. M. Gourdin and A. Martin. Nuovo cimento (10) 6, 757-79(1957) Oct. (In French)

The problem of determining a two body (e.g. nucleon-nucleon) interaction in the S state from the energy dependence of the experimental phase shift is studied with the assumption of a non-local separable central interaction. It is shown that, under this hypothesis, the interaction is given, in momentum space, by the solution of a Fredholm inhomogeneous integral equation of second kind. General properties of this equation enable one to show that, if the physical system has no bound state there exists at most one solution; if the system has one bound state there may exist a one parameter set of solutions. Explicit solutions are obtained when the energy dependence of the phase shift is exactly given by the shape-independent approximation. This treatment is extended to the case where $k \operatorname{tg} \delta$ is a rational function of the energy. In this case, existence and multiplicity of the solutions are related to the number of roots of an algebraic equation that are located in the upper complex half plane. Further, when the phase-shift remains between 0 and π or between 0 and $-\pi$ in the whole range of variation of the energy, these results are similar to those obtained when a local interaction is assumed: if the system has no bound state, the solution is unique; if the system has one bound state there exists a one-parameter set of solutions. On the other hand, if the energy dependence of the phase shift is no longer restricted as above, the problem can only be solved provided the values of the energy where δ goes through $n\pi$ satisfy certain inequalities. The solutions then obtained are correct in a mathematical sense, but their physical interest is questionable, because, in this case, there is no longer stability of the phase shift with respect to small variations of the interaction. (auth)

4384

ON THE STRONG INTERACTIONS. J. C. Polkinghorne (Univ. of Edinburgh, Scotland). Nuovo cimento (10) 6, 864-8(1957) Oct.

A previous four-dimensional isotopic formalism is rediscussed in the light of suggestions by Gell-Mann and Schwinger concerning the types of strong interactions. A

form for the medium-strong K-meson interactions is investigated. (auth)

4385

NON CONSERVATION OF PARITY AND THE UNIVERSAL FERMI INTERACTION. J. Tiomno. Nuovo cimento (10) 6, 912-16(1957) Oct.

The possibility of the Universal Fermi Interaction is reexamined in face of the recent experimental results on non conservation of parity. It is shown that if the μ meson and the electron have neutrinos of opposite spirality associated with them then the Universal Fermi interaction can be regained in the form S + P + T in the usual β-decay ordering in opposition to the exclusion of the U.F.I. which results from the Yang-Lee theory. This interaction previously proposed by Caianiello and by the present author has the special feature of being symmetrical in the exchange of the two particles or of the two antiparticles. The predictions of this theory for μ^+ decay coincide with those of the Yang-Lee theory with the difference that the positron spin points forward instead of backward. (auth)

4386

POLARIZATION EFFECTS IN BETA DECAY ACCOMPANIED BY INTERNAL BREMSSTRAHLUNG. J. Sawicki and J. Szymanski (Univ. of Warsaw). Nuovo cimento (10) 6, 982-4(1957) Oct.

The calculations were performed under the assumption of the two-component neutrino theory, although the generalization for an arbitrary admixture of the parity nonconserving terms modifies the results for the polarizations only by a constant factor. The method and notation used were previously applied by Cutcosky to the calculation of the spectra and angular distributions of internal bremsstrahlung γ rays. The bremsstrahlung effect tends to increase the effect of the electron polarization, independently of the coupling assumed. (M.H.R.)

4387

ON THE CHARGE DISTRIBUTION OF THE NUCLEON. Y. Nogami (Univ. of Osaka Prefecture, Sakai, Japan). Nuovo cimento (10) 6, 985-8(1957) Oct.

The relativistic corrections and the nucleon current contribution to pion-theoretical calculations of the charge distribution of the nucleon were examined using the covariant perturbation method combined with cut-off method. It is concluded that the electromagnetic structure of the nucleon will not be satisfactorily explained by the conventional theory of the pion-nucleon interaction. (M.H.R.)

4388

ON GAUGE INVARIANCE OF SECOND KIND. B. Ferretti (CERN, Geneva). Nuovo cimento (10) 6, 997-8(1957) Oct.

A brief proof is given that gauge invariance of the second kind seems to be not only a sufficient, but a necessary condition for the existence of local conservation laws expressed by the vanishing of the divergence of a four current. The precise meaning of this statement is included. (M.H.R.)

4389

ON THE CONSERVATION OF LEPTON NUMBER. B. Ferretti (CERN, Geneva). Nuovo cimento (10) 6, 999-1000 (1957) Oct.

In interactions between leptons and nucleons, the conservation law for light particles is independent from the other invariance properties of the theory of weak interactions and depends only on certain expressions of the second degree in the coupling constants which are invariant with respect to a canonical transformation which may mix the neutrino and anti-neutrino states. This theorem of Pauli is shown to hold in the case not only of the lepton-nucleon interaction, but also the interaction which leads to the μ decay. (M.H.R.)

4390

GENERAL THEORY OF PARTICLE MIXTURES. Ko Aizu (Rikkyo Univ., Ikebukuro, Tokyo). Nuovo cimento (10) 6, 1040-51(1957) Nov.

The general theory of particle mixtures is developed and their remarkable time behavior at decay is shown to be a natural consequence of degeneracy of the initial state. Applications to several simple cases, positronium in a magnetic field, K^0 and $\bar{K}^0$ particle mixture and a possible θ-τ doublet are discussed. In particular it is shown that, if the K^0 has two lifetimes, the mass difference between K^0 and $\bar{K}^0$ caused by a possible non-invariance of strong interaction under charge-conjugation cannot exceed much the value 10^{-5} ev. (auth)

4391

VELOCITY-DEPENDENT NUCLEAR INTERACTION. II. LEVEL SCHEMES. W. E. Frahn and R. H. Lemmer (National Physical Research Lab., C.S.I.R., Pretoria, South Africa). Nuovo cimento (10) 6, 1221-4(1957) Nov.

The eigenvalue spectrum of the single-particle wave equation was investigated using the isotropic harmonic oscillator potential. (M.H.R.)

4392

ADDITIONAL REMARKS AND ERRATA CORRIGE TO A PAPER ON THE THEORY OF SPIN 2 PARTICLES. T. Regge. Nuovo cimento (10) 6, 1233-4(1957) Nov.

Some additional properties of the γ_μ matrices are given, along with corrections of misprints. (M.H.R.)

4393

THE PRINCIPLE OF THE MINIMUM NUMBER OF STATES AT WEAK INTERACTIONS. G. Marx. Nuovo cimento (10) 6, 1235-7(1957) Nov.

This hypothesis is introduced: Every elementary particle is described by a field quantity corresponding to an irreducible representation of all the symmetry transformations of interactions. It is postulated that the principle of the minimum number of states has universal validity for elementary particles. No particle exists for which the number of observed states would exceed the minimum (such a particle would be e.g. an anti-neutrino polarized in the forward direction, a $\bar{\pi}^0$ meson or a K-meson parity doublet). It is emphasized that before adopting this principle the proper symmetry transformations of the particle interactions must be well known. (M.H.R.)

4394

CENTER-OF-GRAVITY THEOREM IN NUCLEAR SPECTROSCOPY. R. D. Lawson and J. L. Uretsky (Univ. of California, Berkeley). Phys. Rev. 108, 1300-4(1957) Dec. 1.

The j-j coupling shell model implies the existence of certain geometrical relations among the spectra of neighboring nuclei. One such relationship between states of a nucleus that is one proton or neutron away from a closed shell with states of the corresponding closed-shell nucleus is considered. Use of this relationship has enabled us to predict excited-state spins for several nuclei, most of which are in the vicinity of mass number 60. In two cases the existence of states that have not been observed is predicted. (auth)

4395

ANGULAR MOMENTUM COUPLING IN ODD-ODD NUCLEI. Sudhir P. Pandya (Univ. of Rochester, N. Y.). Phys. Rev. 108, 1312-14(1957) Dec. 1.

Some general results are derived for the odd-group model of odd-odd nuclei and used to discuss the validity of the model. (auth)

4396

DERIVATION OF THE FORMULA FOR THE CROSS SEC-

TION FOR FORMATION OF HIGH ENERGY NEUTRONS IN DEUTERON-NUCLEI COLLISIONS. V. S. Anastasevich. Soviet Phys. JETP 5, 520(1957) Oct.

A formula is derived for the effective cross section for the formation of neutrons by the stripping reaction. (L.T.W.)

Nuclear Properties

4397 NRDC-94

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SUMMARY OF EXPERIMENTAL DATA ON THE ENER ENERGY DEPENDENCE OF ν. J. E. Sanders. May 1956. Decl. Nov. 29, 1957. 5p.

The available experimental data on the variation of the number of neutrons per fission with the energy of the neutrons inducing fission are summarized. Two experimental techniques were employed: an extension of the coincidence method used for determining ν for thermal fission and a comparison of the value of ν for spontaneous fission of the nuclide (A,Z) with the value for thermal neutron induced fission of the nuclide (A-1,Z). The difference in ν is then attributed to a change in excitation of the nuclide (A,Z) equal to the neutron binding energy. Results are tabulated and graphed. (M.H.R.)

4398 UK/0/6/119

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE RATIO OF THE RESONANCE INTEGRAL TO THE 2200 m/s CROSS SECTION FOR Pu-240. [Paper presented at] Sixth UK/Canada Technical Conference, Chalk River, Ontario, October 21-22, 1957. W. H. Walker and C. H. Westcott. Sept. 1957. 9p.

The ratio was determined by comparing the Cd ratios of Pu^{240} and Au. Values of 39 ± 2 Mev for the 1.06 ev resonance width and 335 b for the 2200 m/sec cross section were obtained. A collimated beam of neutrons from the NRX was used in the measurements. The experimental arrangement is shown. (D.E.B.)

4399

AERODYNAMIC RESISTANCE OF FUEL ELEMENTS. Alfred Schraud. Atomkern Energie 2, 443-4(1957) Nov.-Dec. (In German)

4400

HETEROGENEOUS FUEL DISTRIBUTION IN REACTORS FOR THE PRODUCTION OF CONSTANT POWER DENSITY PER UNIT VOLUME. F. Winterberg. Atomkern Energie 2, 456-66(1957) Nov.-Dec. (In German)

4401

NUCLEAR EVAPORATION OF Cu. E. Jeannet, J. Rossel, and E. Vaucher. Helv. Phys. Acta 30, 484-8(1957). (In French)

Experiments with a leaf of Cu between two nuclear emulsions exposed at 3600 meters above sea level for 3 months are described. An attempt to explain some proton and low-energy alpha tracks is made. (T.R.H.)

4402

INELASTIC SCATTERING OF 150 Mev NEGATIVE PIONS BY CARBON AND LEAD. R. H. Miller (Univ. of Chicago, Ill.). Nuovo cimento (10) 6, 882-911(1957) Oct.

Energy sensitive counters of the Čerenkov or scintillation type were used in conjunction with a pulse height analyzer to measure the energy spectrum of 150 Mev negative pions scattered from carbon or lead at various angles. Most of the pions scattered into the backward hemisphere had an energy less than 40 Mev. This is in contrast to the result of a Monte Carlo calculation based on a simple Fermi gas model, in which most of the pions scattered backwards have energies above 60 Mev. The measurements indicate that the absorption of pions by carbon is about that predicted by the Monte Carlo calculation, while the absorption by lead is about ¼ that expected. (auth)

4403

BETA-GAMMA DIRECTIONAL CORRELATION IN ^{170}Tm. G. Bertolini, E. Lazzarini, and M. Mandelli Bettoni. Nuovo cimento (10) 6, 1106-12(1957) Nov.

The shape of the β spectrum of Tm^{170} of maximum energy 889 kev was studied with a magnetic spectrometer and $\beta-\gamma$ coincidences. The existence of a correlation between the 889 kev decay electron and the 84 kev γ ray of Tm^{170} was confirmed using a scintillation detector. The results agree with an assignment for spin and parity of 1 for the ground state of Tm^{170}. Under this hypothesis, the ratios of matrix elements in the β transition which are in best agreement with the experimental data were found. (tr-auth)

4404

EFFECT OF THE SPIN-ORBIT POTENTIAL ON THE MAGNETIC MOMENT OF THE DEUTERON. J. J. Swart, R. E. Marshak, and P. S. Signell (Univ. of Rochester, N. Y.). Nuovo cimento (10) 6, 1189-92(1957) Nov.

It is shown that at the present stage the contribution to the magnetic moment of the deuteron does not pose a serious dilemma for the spin-orbit potential explanation (in addition to the Gartenhaus potential) of the high energy nucleon-nucleon scattering (up to 150 Mev). (auth)

4405

NUCLEAR MAGNETIC RESONANCE IN PARAMAGNETIC MnF_2. R. G. Shulman and V. Jaccarino (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 108, 1219-31 (1957) Dec. 1.

Nuclear magnetic resonances of F^{19} in single crystals of paramagnetic MnF_2 were observed in the temperature region 68 to 300°K. Shifts of the resonances from the predicted field, ω/γ, were as large as 8%. With the external magnetic field not in the ab plane, two separate resonances were observed corresponding to the two different F positions in the unit cell. Both the shifts and the splittings were functions of magnetic field, temperature, and crystal orientation. As the temperature was increased, the line widths increased from 25 to 42 oe. These observations were explained by postulating a small degree of covalency in the F^- bond to the paramagnetic Mn^{++} ion. Each bond includes 0.48 ± 0.02% F 2s character. The contributions of the $2p_\sigma$ and $2p_\pi$ orbitals are discussed and the effects of the covalency upon the long-range order and the superexchange mechanism are considered. The lines disappeared abruptly at the Néel temperature, T_n, (68 ± 1°K) because the sudden increase in sublattice magnetization shifts them beyond the frequency range of the spectrometer. Attempts to observe the resonances at low temperatures are described. (auth)

4406

THEORY OF HYDROGEN DEUTERIDE IN MAGNETIC FIELDS. Norman F. Ramsey and Henry R. Lewis (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 1246-50(1957) Dec. 1.

The Hamiltonian for the diatomic $^1\Sigma$ heteronuclear molecule HD in a magnetic field is discussed. Included in the Hamiltonian are the effects of the nuclear and rotational magnetic moments interacting with the external magnetic field, magnetic shielding, molecular diamagnetism, and spin-spin magnetic interaction of the two nuclei, the interaction of the nuclear magnetic moments with the field due to the rotation of the molecule, the interaction of nuclear

electric quadrupole moment, and the electron coupled nuclear spin-spin interaction. General expressions for the matrix elements of such a Hamiltonian are developed. Perturbation theory expressions for the energy of HD in the first rotational state are obtained in both strong- and weak-field limits. General expressions are given up to third order and numerical perturbation coefficients as calculated with a digital computing machine are given up to ninth order. The secular equation for HD is numerically solved for intermediate fields. Curves are given showing the theoretical dependence of the energy upon the field. Effects of zero-point molecular vibration and centrifugal stretching are discussed. (auth)

4407

GAMMA-RAY EXCITATION OF Ta^{181} ISOMER. J. E. Draper and R. L. Hickok (Yale Univ., New Haven, Conn.). Phys. Rev. 108, 1280-3(1957) Dec. 1.

The 615-kev isomeric state in Ta^{181} was excited by 6-Mev bremsstrahlung γ rays. The half life and gamma ray spectra were measured with a NaI(Tl) scintillation detector. The measured half life is 18.1 ± 0.3 μsec. The relative intensities of the 134-, 346-, and 482-kev γ rays and the 56-kev x ray from internal conversion are 57, 16, 100, and 32 and agree with the results obtained from the excitation of this state by beta decay of Hf^{181}. An estimate of the yield is given. (auth)

4408

ELASTIC SCATTERING OF ALPHA PARTICLES AND DEUTERONS FROM HEAVY NUCLEI. J. R. Rees and M. B. Sampson (Indiana Univ., Bloomington). Phys. Rev. 108, 1289-93(1957) Dec. 1.

The angular distributions of 22-Mev alpha particles and 11-Mev deuterons scattered elastically from Ta, Au, Bi, and U were measured at angles of 20 to 160° in the laboratory system. It is found in all cases that the deuteron cross sections depart from the Rutherford angular dependence at smaller angles than the alpha-particle cross sections for the same nuclei, indicating electric breakup of the deuteron. (auth)

4409

INTERNAL CONVERSION COEFFICIENTS OF γ RAYS IN Pu^{239}. G. T. Ewan, J. W. Knowles, and D. R. MacKenzie (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Phys. Rev. 108, 1308-11(1957) Dec. 1.

The K-conversion coefficients of the predominantly M1 γ rays of 209.7, 228.2, and 277.9 kev following the β decay of Np^{239} were measured using a curved crystal γ-ray spectrometer and a lens type β-ray spectrometer. The measured K-conversion coefficients are 1.76 ± 0.30, 1.60 ± 0.16, and 1.16 ± 0.12, respectively. A limit of less than 10% has been placed on the admixture of E2 in these radiations from a study of the K/L and $L_I : L_{II} : L_{III}$ conversion ratios. It is found, for Z = 94, that the measured conversion coefficients show better agreement with the M1 predictions of Sliv who allowed for finite nuclear size than with Rose et al. who assumed a point charge nucleus. In addition, the K-conversion coefficients of the 254.7-, 285.5-, 316.2-, and 334.4-kev γ rays of Pu^{23}, have been measured to be 0.88 ± 0.32, 0.11 ± 0.02, 0.027 ± 0.005, and 0.025 ± 0.005, and the L_I and L_{II} conversion coefficients of the 106.4-kev γ ray to be 0.062 ± 0.007 and 0.071 ± 0.007, respectively. (auth)

4410

PRODUCTION CROSS SECTIONS OF K^+ MESONS BY 3-Bev PROTONS ON H, Li, AND Cu. P. Baumel, G. Harris, J. Orear, and S. Taylor (Columbia Univ., New York). Phys. Rev. 108, 1322-6(1957) Dec. 1.

Liquid hydrogen, lithium, and copper targets were exposed to the Cosmotron 3-Bev external proton beam. Nuclear emulsion stacks were used to detect momentum-analyzed K^+ and π^+ mesons of momentum 280 Mev/c leaving the target at 0° in the laboratory system. Correcting for decay in flight, the π^+/K^+ ratios are (630 ± 110), (290 ± 48), and (304 ± 50) for the respective hydrogen, lithium, and copper targets. The laboratory system differential cross sections for K^+ production are $(4.8 \pm 1.0) \times 10^{-32}$, $(3.5 \pm 0.7) \times 10^{-31}$, and $(3.0 \pm 0.6) \times 10^{-30}$ cm^2/sterad Mev per hydrogen, lithium, and copper nucleus, respectively. Assuming at K^+ energy dependence proportional to the final state density (energy independent matrix element) the integrated K^+ production cross sections are 0.21, 1.7, and 14.7 mb for hydrogen, lithium, and copper. For a matrix element proportional to the K^+ momentum in the center of mass and assuming a $\cos^2\theta$ distribution the p-p cross section also happens to be 0.21 mb. The π/K ratios indicate that K^+ production by p-p is not suppressed significantly relative to that by p-nucleus and that the Li to Cu Z-dependence of K^+ production appears the same as for π^+ production. Our integrated cross sections suggest that strange particle production by 3-Bev protons occurs ~ 1% of the time. (auth)

4411

OXYGEN DIFFERENTIAL NEUTRON SCATTERING AND PHENOMENOLOGICAL NUCLEAR POTENTIALS. J. L. Fowler and H. O. Cohn (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 89-93(1958) Jan. 1.

The neutron differential elastic scattering cross section of O^{16} has been measured at and in the vicinity of the 1-Mev resonance as well as at higher nonresonant energies. A phase-shift analysis of the results gives the $s_{1/2}$, $p_{1/2}$, $p_{3/2}$, and $d_{3/2}$ phase shifts up to 2.4-Mev neutron bombarding energy. The bound single-particle states of O^{17}, as well as the s- and d-wave phase shifts, determine the parameters of a phenomenological potential well which describes the average interaction of the neutron with the O^{16} core. This potential has a depth around 50 to 45 Mev, which varies slightly for different single-particle configurations, and has a diffuse boundary with a Thomas-type spin-orbit energy term. It is consistent with the potentials which in other work are found to fit data of much higher mass. (auth)

4412

RADIONUCLIDE K^{37}. C. R. Sun and Byron T. Wright (Univ. of Calif., Los Angeles). Phys. Rev. 109, 109-12 (1958) Jan. 1.

The radionuclide K^{37} has been produced by a (p,α) reaction on Ca^{40}, using 12.8-Mev protons accelerated in the UCLA 20-Mev synchrocyclotron. The half life of this activity was found to be 1.2 ± 0.12 seconds. With a double-channel magnetic spectrometer the end point of the β spectrum was determined as 5.10 ± 0.07 Mev. The ft value determined as 4150 ± 500 seconds is within the expected range of the shell-model predictions. The Coulomb energy difference between K^{37} and A^{37} deduced from the end point agrees with Peaslee's analysis of the light nuclei. The pairing effect in Coulomb energies discussed by Carlson and Talmi is more clearly exhibited with the addition of the new data. (auth)

4413

NUCLEAR SYMMETRY ENERGY. Hans-Peter Duerr (Univ. of California, Berkeley). Phys. Rev. 109, 117-21 (1958) Jan. 1.

On the basis of a phenomenological theory proposed in an earlier paper the nuclear symmetry energy is recalculated. The value obtained is smaller than the one given before, which was incorrect. A relativistic calculation of the energy with the radius parameter $r_0 = 1.07 \times 10^{-13}$ cm of the electron scattering experiments yields about the correct symmetry energy. Compensating uncertainties due to inaccuracy in r_0, corrections due to the exclusion prin-

ciple, and a possible difference in the radius of proton and neutron distributions make an accurate comparison with the empirical symmetry energy meaningless. (auth)

4414

SUPERHEAVY NUCLEI. Frederick G. Werner and John A. Wheeler (Princeton Univ., N. J.). Phys. Rev. 109, 126-44 (1958) Jan. 1.

The semiempirical mass formula and other data previously extrapolated indicated possible existence of nuclei with mass values up to twice the largest now known. Here this mass region is further explored. Extrapolations are revised and the properties of such superheavy nuclei are estimated in more detail. Despite Z values substantially higher than 137, the K electrons behave perfectly normally because of the finite extension of the nucleus. Vacuum polarization and vacuum fluctuations are roughly estimated to make relatively minor alterations in the K electron binding—which exceeds mc^2. The effect of nuclear attraction in speeding up beta decay is calculated approximately. Calculated beta lives are never much less than 10^{-4} sec. Beta decay energies and neutron binding energies are calculated from the semiempirical mass formula. Fission barriers and cross sections for the (n,γ) process are estimated. Branching ratios in beta decay are calculated for the processes of simple beta decay and for "delayed" neutron emission and "delayed" fission. The latter quantity sets an irreducible minimum to the losses that occur in the process of buildup under even the heaviest neutron flux. The calculated fractional yield of nuclei which react Z = 147, A = 500 is >0.05. Under a lower flux the losses are greater. All stability calculations in this paper depend upon substantial extrapolations, with complete disregard of shell effects and other particularities that may be important, and therefore can be completely in error. Conversely, observation of existence or absence of superheavy nuclei with lives less than a second should test stringently the semiempirical mass formula and the semiempirical estimates of spontaneous fission barriers. (auth)

4415

OBSERVATION OF NUCLEAR RESONANCE ACOUSTIC ABSORPTION OF In^{115} IN InSb. M. Menes and D. I. Bolef (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 109, 218-19(1958) Jan. 1.

The absorption of acoustic energy at the resonant frequency of In^{115} in a single crystal of InSb was observed directly. The absorption was observed at both the normal nuclear magnetic resonance frequency ($\Delta m = \pm 1$) and at the double resonance frequency ($\Delta m = \pm 2$). (L.T.W.)

4416

STUDIES WITH SCINTILLATION COINCIDENCE SPECTROMETER: Se^{75} AND Sb^{125}. Girish Chandra (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. A46, 360-6(1957) Nov.

Cascade relationships between γ-transitions in the decay of Se^{75} and Sb^{125} were investigated with the help of a scintillation coincidence spectrometer. A decay scheme for Se^{75} was proposed. (auth)

4417

THE BINDING ENERGY OF ^{8}Be AND ^{12}C. S. J. Biel (Univ. Coll., London). Proc. Phys. Soc. (London) A70, 866-76(1957) Dec.

A general group-theoretic method is given for the enumeration of the integrals in the resonating group structure method of the alpha particle model of the alpha nuclei. The general methods are then applied to the calculation of the binding energies of Be^8 and C^{12}. These calculations are carried out using Gaussian wave functions and a Gaussian central force potential, which is taken to be the mixture of the Wigner, Bartlett, Heisenberg and Majorana interactions. The variational method is used to fix the parameter determining the separation between the alpha particle clusters. Two types of exchange dependence of the potential are considered corresponding to symmetrical forces and to Serber forces respectively. The former gives no binding (both for Be^8 and C^{12}) while the latter overestimates the binding energies. A mixture of about 30% of the symmetric force and 70% of the Serber force gives the correct values for the binding energies. A simple transformation is used to calculate the Coulomb energy from the previously evaluated integrals for the Gaussian potential. (auth)

4418

ENERGY LEVELS OF LIGHT NUCLEI (Z = 11 TO Z = 20). II. P. M. Endt and C. M. Braams. Revs. Mod. Phys. 29, 683-756(1957) Oct.

The experimental material on energy levels published from December 1, 1953 to February 1, 1957 is covered along with the 1954 energy level compilation [P. M. Endt and J. C. Kluyver, Revs. Mod. Phys. 26, 95(1954)]. Little attention is given to cross-section measurements. Many particle reactions, as (n,2n) or spallation reactions, are omitted altogether. Theoretical papers are quoted only briefly. Numerous diagrams and tables and an extensive bibliography are given. (M.H.R.)

4419

NUCLEAR DISINTEGRATION ENERGIES. II. D. M. Van Patter (Bartol Research Foundation, Swarthmore, Penna.) and Ward Whaling (California Inst. of Tech., Pasadena). Revs. Mod. Phys. 29, 757-66(1957) Oct.

New measurements of nuclear reaction energies available from 1954 up to February 1, 1957 are included. [D. M. Van Patter and W. Whaling, Revs. Mod. Phys. 26, 402 (1954)]. In addition, any measured values tested in the original 1954 compilation which were revised or reassigned since its publication are given. (M.H.R.)

4420

TABLE OF TOTAL BETA-DISINTEGRATION ENERGIES. II. L. J. Lidofsky (Columbia Univ., New York). Revs. Mod. Phys. 29, 773-830(1957) Oct.

Supplementary data, through March 1, 1957, to the compilation of R. W. King, Revs. Mod. Phys. 26, 327(1954), are given. (M.H.R.)

4421

TABLE OF ALPHA-DISINTEGRATION ENERGIES OF THE HEAVY ELEMENTS. Frank Asaro and I. Perlman (Univ. of California, Berkeley). Revs. Mod. Phys. 29, 831-6(1957) Oct.

This compilation is a revision of the "Table of Alpha-Disintegration Energies of the Heavy Elements" published in 1954 [F. Asaro and I. Perlman, Revs. Mod. Phys. 26, 456(1954)]. Included are new α emitters and revisions concerning those previously listed. (M.H.R.)

4422

ELECTRIC MONOPOLE TRANSITIONS IN NUCLEI WITH ODD MASS NUMBERS. L. K. Peker and L. A. Sliv. Soviet Phys. JETP 5, 515-16(1957) Oct.

4423

LEVEL SHIFT OF π-MESONIC ATOMS. S. M. Bilen'kii. (United Inst. for Nuclear Research). Soviet Phys. JETP 5, 517-18(1957) Oct.

4424

THE DECAY SCHEME OF Ag^{105}. M. Raether. Z. Physik 150, 38-48(1958). (In German)

4425

NUCLEAR MASSES AND THEIR DETERMINATION. PRO-

CEEDINGS OF THE CONFERENCE HELD IN THE "MAX-PLANCK-INSTITUT FÜR CHEMIE" MAINZ, JULY 10-12, 1956. H. Hintenberger, ed. New York, Pergamon Press, 1957. 274p. $14.00.

The proceedings of a conference on the precision determination of atomic nuclear masses, held in the Max-Planck-Institute for Chemistry in Mainz in honor of Professor J. Mattauch, Director, are presented. After an article by Professor Otto Hahn and an introductory article on the present status of the determination of nuclear masses by K. T. Bainbridge, the papers are grouped in the following sections: atomic masses and nuclear structure, mass-spectroscopic results, nuclear masses from nuclear reactions, comparison between nuclear masses from Q-values and mass-spectroscopic doublets, atomic masses from nuclear wave spectra, and instruments. Discussion is included. (M.H.R.)

Nuclear Reactors

Refer also to abstracts 4589, 4611, 4621, 4628, 4629, 4631, 4632, 4638, 4639, 4640, and 4643.

4426 AD-125192

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A NUCLEAR REACTOR SIMULATOR (thesis). Glenn Graham Sherwood. Mar. 1957. 50p.

Since World War II, electronic simulators have played an important role in predicting the response of physical systems. Special purpose simulators have been developed to solve the nuclear reactor kinetic equations which describe power levels. In this thesis a nuclear reactor simulator was designed and constructed. It was composed of two major parts, a working model of the swimming pool reactor, and a control panel which contained the control equipment. A small analog computer was used to generate the power output in the simulator. The equipment used for control of the simulator included three servo systems, a d-c motor to operate the control rod, various relays, and an automatic scram device. The completed simulator provided an interesting engineering experiment. It was used to demonstrate the general operation of a nuclear reactor, the use of the various reactor controls, and the response of the reactor kinetic equations. (auth)

4427 AECU-3598

[Los Alamos Scientific Lab., N. Mex.].
ANALYSIS OF PROMPT EXCURSIONS IN SIMPLE SYSTEMS. W. R. Stratton and T. H. Colvin. [1957?]. 25p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

A calculation, coded for a fast computer, is discussed that can fairly accurately match the experimental results obtained from the LASL Lady Godiva prompt burst program. In particular, the code can predict the reactivity where the burst yield deviates from a linear dependence on reactivity and commences to rise much more rapidly. The burst width and maximum rates can be predicted with reasonable accuracy. The calculation is applied to other simple systems, with the result that there appear to be general rules that one can use to relate the bursts of these systems. The calculation can predict what fraction of the energy of the system is converted into kinetic energy. It appears that step-function increases of reactivity of about 10 cents or less in homogeneous metal systems develop only a trivial explosive energy. The method was extended to hypothetical accidents in very idealized reactors. Two general models of reactor cores were considered. These are (1) a core of low density in which the characteristic of a threshold is important, and (2) a model in which the spherical shells are alternately normal density and void. The numbers quoted should be regarded only as establishing upper and lower limits. (auth)

4428 AECU-3604

Los Alamos Scientific Lab., N. Mex.
CRITICAL ASSEMBLIES OF GRAPHITE AND ENRICHED URANIUM WITH BERYLLIUM REFLECTORS. G. E. Hansen, J. C. Hoogterp, J. D. Orndoff, and N. C. Paxton. 20p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70 (mf OTS).

Data are given on properties of three sets of cylindrical Be reflected, graphite-moderated critical assemblies. The first set was primarily to establish characteristics as functions of C/Oy atomic ratio of core with nearly constant reflector thickness. Fission distributions were determined. The second set consisted of three assemblies with fixed core to determine the effect of redistributing reflector from the ends to the cylindrical wall. This series was done to provide the Los Alamos Scientific Laboratory's Theoretical Division checks for two-dimensional diffusion code. Flux distributions in the uniformly-reflected assembly were mapped extensively with bare and Cd-shielded foils of oralloy, Au, and In. The third set was to establish the minimum-volume core at C/Oy ~ 350 that could be made critical with available Be. Experimental critical data converted to equivalent spherical systems are compared with results of S_4 calculations. (auth)

4429 AECU-3605

Los Alamos Scientific Lab., N. Mex.
GRAPHITE-MODERATED, GRAPHITE-REFLECTED CRITICAL ASSEMBLIES. Cleo C. Byers. [1957?]. 12p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

Graphite-moderated, graphite reflected critical assemblies have been set up in the LASL Honeycomb remotely controlled machine. Information has been obtained on the critical masses of systems having C/Oy ratios of 6650 and 4093. A third system at a smaller ratio is planned. The reactivity contribution of channels through the core and reflector was determined. (auth)

4430 ANL-5719

Argonne National Lab., Lemont, Ill.
EXPERIMENTAL BREEDER REACTOR II (EBR-II); HAZARD SUMMARY REPORT. L. J. Koch, H. O. Monson, D Okrent, M. Levenson, W. R. Simmons, J. R. Humphreys, J Haugsnes, V. C. Jankus, and W. B. Loewenstein. May 1957. 401p. Contract W-31-109-eng-38. $6.50(OTS).

The EBR-II consists of an enriched core surrounded by a fertile blanket of depleted U. The fuel pins fit loosely in a thin walled tube filled with static Na for a heat transfer bond. Heat is removed by the primary Na flowing along the outside of the fuel tube. The fuel element lends itself to remote control fabrication methods. Effort was made to achieve a rigid, close-packed arrangement of the fuel and to produce preferential bowing such as to effect a probable bowing coefficient which is essentially zero or negative. Reactor control is effected by movement of fuel into and out of the reactor core. Heat is removed by the primary Na coolant system and transferred to the secondary Na system in a shell-and-tube heat exchanger. The reactor and entire primary system, including heat exchanger, are contained in a large vessel (primary tank) and operate completely submerged in coolant. The large volume of Na in the primary system provides a reliable source of constant temperature coolant. Shutdown cooling is accomplished by natural convection. This bulk volume of Na is also used as coolant during reactor unloading. The reactor, primary coolant system, and all associated equipment are contained in a building in the form of a gastight cylindrical

steel sheel (with a normal safety factor of approximately four). Two potential sources of accidental energy release are treated separately. The major design and operating features of the EBR-II plant are summarized. (M.H.R.)

4431 CERD-0005-RS-9

Combustion Engineering, Inc. Reactor Development Div., Windsor, Conn.

SUMMARY OF PROGRESS IN UNCLASSIFIED AREAS OF REACTOR TECHNOLOGY. Oct. 18, 1957. 11p. $3.30 (ph OTS); $2.40(mf OTS).

Progress is reported on fast neutron scattering calculations, few group constants for criticality, cold startup analysis, flux behavior near control rods, and the radioautographic technique for power distribution measurements in a critical assembly. (For preceding period see CERD-0005-RS-5.) (M.H.R.)

4432 CF-54-6-4

Oak Ridge National Lab., Tenn.

RELEASE OF XENON FROM FLUORIDE FUELS: PROPOSAL FOR AN EXPERIMENTAL PROGRAM. M. T. Robinson. June 2, 1954. Decl. Sept. 27, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Studies of methods of detecting noble gases and the selection of suitable gaseous species are summarized. An indication of the effort required for each of several different methods is given. The best available program of research is outlined in detail. (M.H.R.)

4433 CF-56-6-33

Oak Ridge National Lab., Tenn.

HRR FUEL ENRICHMENT. D. R. Gilfillan. June 5, 1956. Decl. Mar. 13, 1957. 2p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

4434 CF-57-10-41

Oak Ridge National Lab., Tenn.

MOLTEN SALTS FOR CIVILIAN POWER. H. G. McPherson. Oct. 10, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Molten salts provide the basis of a new family of liquid fuel power reactors. The range of solubility of uranium and thorium compounds makes the system flexible, and allows the consideration of a variety of reactors. Suitable salt mixtures have melting points in the 850 to 950°F range and will probably prove to be sufficiently compatible with known alloys and to provide long-lived components, if the temperature is kept below 1300°F. Thus the salt systems naturally tend to operate in a temperature region suitable for modern steam plants and achieve these temperatures in unpressurized systems. Some economic and other considerations are made. (T.R.H.)

4435 CF-57-12-45

Oak Ridge National Lab., Tenn.

HEAT GENERATION RATE IN CORE TANK OF HRE-3. H. C. Claiborne and T. B. Fowler. Dec. 12, 1957. 27p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Heat generation rates in the core tank of HRE-3 were calculated for a number of possible operating conditions. The calculated values were between 9 and 11 watts/cc. If all cases were adjusted to the same total reactor power, the differences would be in the order of only a few tenths watts/cc. Replacing the UO_2SO_4-D_2O solution core with a 200 gm Th/liter–UO_3 slurry reduces the heat generation rate by 30%. In these calculations the experimental results for γ energy release of fission of U^{235} were used since the results for U^{233} fission are not available. The method of calculation used was previously applied in estimating the heat generation rates in parts of the Bulk Shielding Facility with good results. (auth)

4436 CF-57-12-100

Oak Ridge National Lab., Tenn.

FLUX DISTRIBUTION IN A REACTOR CONSISTING OF A SPHERICAL SHELL OF FUEL IN A INFINITE MODERATOR. W. K. Ergen. Dec. 24, 1957. 9p Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The general method is given for computing the critical equation and the flux in the center of the "flux trap" in an idealized high-flux reactor based on the flux-trap principle The fuel is concentrated in a spherical, infinitely thin shell in an infinite moderator. The shell emits ηf fission neutrons for each thermal neutron absorbed. Absorption at epithermal energies, both in the fuel and the moderator, are neglected. In this model the fission neutrons emitted from the shell slow down according to the age kernel and they diffuse according to diffusion theory, with the boundary condition created by the "black" shell. Numerical results obtained from the general method described will be issued in a subsequent memo, "Fluxes Obtainable in a Flux-Trap Reactor," CF-58-1-4. (auth)

4437 CRRP-748

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

REACTOR SAFETY. G. C. Laurence. Dec. 1957. 32p. (AECL-538).

A discussion is presented of some of the important current ideas and practices for safe design and operation of nuclear reactors, based on a lecture at Chalk River on 24 September, 1957. (auth)

4438 DCI-27

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A SUGGESTED METHOD FOR CALCULATING THE DIFFUSION OF RADIOACTIVE RARE GAS FISSION PRODUCTS FROM UO_2 FUEL ELEMENTS AND A DISCUSSION OF PROPOSED IN-REACTOR EXPERIMENTS THAT MAY BE USED TO TEST ITS VALIDITY. A. H. Booth. Sept. 1957 10p.

The calculations reported in CRDC-721 regarding the diffusion of stable rare-gas fission products from UO_2 fuel elements were extended to apply to the radioactive isotopes also. Two proposed in-reactor experiments, in which the rate of release of short lived radioactive Xe and Kr isotopes will be measured during the irradiation of test fuel elements, may be used to test the hypothesis on which the calculations are based. (auth)

4439 HW-45548

[General Electric Co. Hanford Atomic Products Operation, Richland, Wash.].

PRELIMINARY INVESTIGATION OF D_2O MODERATED DEMONSTRATION REACTOR. Harold S. Davis, D. Marinos, and Glen A. Newell. Sept. 13, 1956. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The basic engineering problems involved in the design of a pressurized D_2O cooled and moderated reactor were evaluated. Two fundamental concepts were considered; a tank-type reactor with pressurized fuel channels and unpressurized moderator, and a pressure-vessel reactor with both coolant and moderator pressurized. Both reactor types appear feasible. (D.E.B.)

4440 HW-52891

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRANSIENT BEHAVIOR OF THE FLUIDIZED BED NUCLEAR REACTOR. L. N. Johanson. Sept. 17, 1957. 30p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The transient behavior of a fluidized bed, pressurized

H_2O moderated and cooled reactor using Al-clad U or UO_2 pellets was studied. Of primary concern was the extent of deviation from uniformity, and the effect of this deviation on reactor operation. Fluidization data were taken for $^3/_8$- and $^3/_4$-in. steel spheres in 6- and 9-in. columns. Three types of void fraction variations were found; spatial variation with time in the region of individual fuel elements, variation of fuel to moderator ratio due to bubbles, and variations from a closer packing of spheres at the wall. These void fraction variations were found to be of such an extent that excessive flux and temperature transients would exist without proper sphere size selection, coolant velocity control, and sphere motion control. (D.E.B.)

4441 KAPL-1756(Pts. I & II)
Astra, Inc., Milford, Conn.
THE FAST OXIDE BREEDER—REACTOR ANALYSIS. PART I. NEUTRON YIELDS, CROSS SECTIONS, GROUP CONSTANTS, AND MACHINE ROUTINES. G. A. Baraff and R. B. Mallon. PART II. REACTOR CALCULATIONS. D. F. Molino and J. K. Davidson. June 30, 1957. (Pt. 1, 57p. and Pt. II, 35p.) For Knolls Atomic Power Lab., Contract W-31-109-Eng-52, Subcontract K-314. (Pt. 1, $1.50(OTS); Pt. II, $1.00(OTS).)

These two parts were issued separately, but are cataloged as a unit.

Advanced Scientific Techniques Research Associates (ASTRA) has performed work for KAPL in the area of reactor physics with specific application to the KAPL Fast Oxide Breeder. The results of the first phase of this work, an evaluation of existing information on cross sections in the energy range of interest and on neutron yields for fissionable isotopes, are reported. The methods and techniques developed for reducing the raw data to group constants for PROD II (the code chosen for multigroup calculations) and modifications made to the PROD II code are discussed. The results of a new series of multigroup criticality calculations for the Fast Oxide Breeder reactor are reported. A new compilation of nuclear data prepared by ASTRA personnel was used as input. Among the more important differences between the new results and the original calculations of Luebke and Sampson are: an increase in fuel concentration (U/Pu ratio from 5/1 to 4/1) for the same reactor size and power output, reduction in the total breeding ratio obtainable from about 1.4 to 1.3, and use of fuel movement rather than reflector movement for control. (auth)

4442 KAPL-1789
Knolls Atomic Power Lab., Schenectady, N. Y.
SLAG, A MULTIGROUP AGE CALCULATION. C. D. Petrie. June 1, 1957. 40p. Contract W-31-109-Eng-52. $1.25(OTS).

A one-dimensional multigroup program for the IBM-650, under the code name SLAG, is presented for the calculation of neutron fluxes, ages, and slowing-down densities in a homogeneous medium containing hydrogen. (auth)

4443 KAPL-M-BFC-5
Knolls Atomic Power Lab., Schenectady, N. Y.
PILE OSCILLATOR FEASIBILITY STUDY. B. F. Cassidy. July 27, 1953. Decl. Mar. 12, 1957. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The feasibility of measuring dynamic temperature coefficients by sinusoidally oscillating the reactor power at constant coolant flow is examined. The reasons for choosing sinusoidal oscillations and a suggested Mark A pile oscillator technique are outlined. The experimental system and the analysis used in the study are described. The results can be summarized as follows: It is possible to run the pile oscillator test in the presence of the period of instability caused by a positive temperature coefficient. A temperature coefficient may be detected as a measurable difference in the reactor transfer function while the total contribution to reactivity from that temperature coefficient is as low as 8 cents. (auth)

4444 KAPL-M-DGC-14
Knolls Atomic Power Lab., Schenectady, N. Y.
ACCESSIBILITY TO LOWER REACTOR COMPARTMENT. PART IV. CONTRIBUTION OF SODIUM AND IMPURITIES IN EVAPORATOR, EXPANSION TANK, SUPERHEATER AND PIPES. D. G. Chappell. July 10, 1953. Decl. Mar. 9, 1957. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The γ dose contribution from commercial Na (plus impurities) in pipes, Evaporator, surge tank, and superheater is calculated as a function of days after shutdown. The Na is assumed to be activated one year at full power; the impurities one year at 1/10 power. The Na impurities became the controlling factor 16 days after shutdown; the dose is 452 mr/hr. Elimination of Sc and Co reduces this level to 71 mr/hr. (auth)

4445 KAPL-M-DOD-1
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIOCHEMISTRY OF THE KAPL-30, RUN 5 FUEL ELEMENT TEST. D. Dutina and W. C. Judd. Jan. 8, 1958. 25p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The results of radiochemical analyses on water and crud samples are summarized. Findings are included from routine hot crud filter samples, routine analyses of water samples, decontamination efficiencies by the hot bed, and fission product trends. (M.H.R.)

4446 KAPL-M-EDL-36
Knolls Atomic Power Lab., Schenectady, N. Y.
NO. 11-8 FUEL ROD—NO. 63 PIN CAGE; PRESSURE DROP TESTS AND ECCENTRICITY EFFECTS FOR THE FLOW CONTROLLING INTEGRAL ORIFICE. G. P. Clement and G. C. Capelianis. Mar. 6, 1953. Decl. Mar. 12, 1957. 21p. Contract W-3[1]-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

Included are the hydraulic characteristics of a fuel element, incorporating the flow control integral orifice with a one inch diameter orifice in the support plate. The effects on pressure drop for eccentric positions of the orifice washers are shown. These tests furnished design data for the sizing of orifices for the Mark A fuel element #12 rod and Mark A cage. (auth)

4447 KAPL-M-EDL-99
Knolls Atomic Power Lab., Schenectady, N. Y.
PRESSURE GRADIENTS AROUND UNIVERSAL JOINT THERMAL BAFFLES—MARK "A". Paul A. Benson and Robert G. Jacoby. July 1, 1955. Decl. Mar. 19, 1957. 78p. Contract W-31-109-Eng-52. $12.30(ph OTS); $4.50 (mf OTS).

An investigation was conducted in order to substantiate a theoretical analysis which indicated that surges of hot Na would tend to enter the annulus around the control element. Flow tests were conducted in the half-scale reactor model with water at a temperature of 100°F. The resultant data are presented as curves of the characteristic gradient of pressure at the circumferential surface of the thermal baffles which surround the universal joints. On the basis of these determinations it was possible to design flow restrictions which would eliminate the objectionable surge pattern. (auth)

4448 KAPL-M-FJM-1
Knolls Atomic Power Lab., Schenectady, N. Y.
SUMMARY OF DUPLEX TUBE ANALYSES. F. J. Mehringer. Sept. 28, 1956. Includes Appendices A through G. 73p. Contract W-31-109-Eng-52. $12.30 (ph OTS); $4.50(mf OTS).

The heat transfer characteristics and stress levels in duplex tubes for heat exchangers are interdependent. The various studies of the heat transfer characteristics and stress analyses are summarized. The heat transfer characteristics discussed are those for boiling water, liquid metal, and metal-to-metal contact. Analyses have been made of the fabricating and operating stresses. As a result of these various analyses recommendations were made regarding material properties, tolerances and surface conditions of the tubular components, fabricating procedures, and operating precautions. Where areas of uncertainty still exist tests have been recommended. This information is significant to the S1G Test Steam Generator Program, since this steam generator is to have duplex heat exchanger tubes. (auth)

4449 KAPL-M-JS-2
Knolls Atomic Power Lab., Schenectady, N. Y.
THEORY OF THE NEUTRON-AMPLIFIER REACTOR. J. C. Stewart. Oct. 25, 1957. 55p. Contract W-31-109-eng-52. $9.30(ph OTS); $3.60(mf OTS).

The so-called "neutron amplifier" principle, in which two or more subcritical regions are permitted to interact through a "rectifying" neutron valve of moderator and thermal poison, has been proposed as a means of exciting a large subcritical power-generating region with a small, easily controlled source. An idealized system embodying this principle is investigated using a perturbation approach in two-group diffusion theory. This approach makes possible the evaluation of performance characteristics of the assembly in terms of the separate components. The salient features emerging from the analysis appear to be as follows: (A) The transmission of the rectifier in the backward sense cannot be neglected; its effect is an increase in the control requirements of the source region. (The "gain per stage" in a multi-stage amplifier is limited by the ratio of forward-to-backward transmission.) (B) Owing to the large moderator thickness required to attain a high forward-to-backward transmission ratio, the transmission in the forward sense is rather small. This condition is augmented by the intrinsically poor coupling of the transmitted neutrons to the fundamental mode of the power region. Consequently, the power region must be operated quite close to critical if it is to generate more power than the source region, and the power split (or gain) is sensitive to small changes in reactivity of the power region. Analytical and numerical results are presented. (auth)

4450 KAPL-M-PPU-24
Knolls Atomic Power Lab., Schenectady, N. Y.
PROPULSION AND LOAD CONTROL DESCRIPTION S41/10; PROJECT SIR—MARK A. Aug. 27, 1954. 50p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

The components constituting the propulsion and load control systems for the Project SIR Mark A power plant and the method of operation of these components are described. (M.H.R.)

4451 KAPL-M-SSD-42
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G FUEL ELEMENT FAILURE DETECTION AND LOCATION SYSTEM DESIGN DESCRIPTION. J. C. Childs. Oct. 23, 1956. 30p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The described system performs three distinct functions relative to operational and test requirements; indicates the presence of a fuel element failure, determines the failure location by unit cell, and indicates the size of the defect. Both fission-product detection and tracer detection techniques are used. (D.E.B.)

4452 KAPL-M-SWK-4
Knolls Atomic Power Lab., Schenectady, N. Y.
SIR PPA-30—COMPOSITION AND DESIGN. S. W. Kitchen, G. B. Gavin, H. A. Palmer, and W. B. Wright. July 25, 1955. Decl. Apr. 30, 1957. 9p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The major change associated with PPA-30 is the contraction of the seven ring core (PPA-27) into six rings. Fuel, polyethylene, Zr, and steel were maintained constant and the contraction performed by the removal of Al. The axial dimensions and molar composition of the core, reflectors, and blanket are shown, and the radial design and individual slug design are given. (auth)

4453 KAPL-M-WBW-4
Knolls Atomic Power Lab., Schenectady, N. Y.
TWO-GROUP CALCULATION OF THE RECTIFIER REACTOR. W. B. Wright. Oct. 10, 1957. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A "rigorous" two group critical condition for a slab geometry rectifier reactor was developed. The secular determinant separates into the product of the critical determinants for two uncoupled fuel regions plus terms involving coupling through the valve. Allowing the coupling to vanish initially (i.e., large valve thickness) established k_∞'s for the two regions which are then perturbed as the coupling increases. In this manner $(\delta k_{eff})_{core}$ is determined in terms of $(\delta k_{eff})_{blanket}$ and the power split is evaluated as a function of the system parameters. Numerical results are presented. (auth)

4454 NAA-SR-1934
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FUEL ELEMENTS FOR THE ORGANIC MODERATED REACTOR EXPERIMENT. C. T. Armenoff and M. H. Binstock. Dec. 15, 1957. 82p. Contract AT(04-3)-88. $2.25(OTS).

The development of a floating-plate-type fuel element for the Organic Moderated Reactor Experiment is described. The fuel element is a stainless-steel box containing 16 active fuel plates which float in longitudinal grooves. The floating plates minimize distortion caused by the large temperature differences experienced with the use of an organic coolant. The fuel plates consist of a core of highly enriched UO_2 particles uniformly dispersed in a stainless-steel matrix clad with stainless steel. Techniques for fabricating the fuel plates are also described. The fuel plate is fabricated by hot- and cold-rolling a $^3/_8$-inch thick sandwich assembly into the 0.030-inch thick fuel plate. The sandwich consists of a stainless steel-UO_2 compact encased by a frame and two cover plates of stainless steel. Development of a non-destructive gage to detect variations of UO_2 content in the fuel core of the finished plate and a method of attaching five-mil-diameter thermocouples to five-mil-thick fuel core cladding are noted. (auth)

4455 NAA-SR-2003
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ELECTRICAL ANALOG APPLICATION TO A REACTOR SAFETY DEVICE PROGRAM. Charles C. Weeks. Nov. 15, 1957. 27p. Contract AT-11-1-GEN-8. $1.00(OTS).

An electrical analog was constructed and used to

investigate thermal transient behavior of the fuse component of the AI Mark II Reactor Safety Element. The auxiliary instrumentation required in this application is described and discussed. Experimental results are given for thermal relaxation time determinations as well as fuse delay times for exponential transients representing reactor excursions. Convenience, speed, flexibility, and economy of this experimental method are emphasized. (auth)

4456 NAA-SR-2006

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ZIRCONIUM MODERATOR REFLECTOR CAN DEVELOPMENT FOR THE SRE. J. A. Leppard. Dec. 15, 1957. 35p. Contract AT(04-3)-49.. $1.00(OTS).

The graphite moderator used in the Sodium Reactor Experiment is sealed against the liquid Na coolant by being enclosed in Zr cans. These cans are 10-ft long and hexagonal in cross section, measuring 10.8 in. across the flats. The moderator cells have a 2.8-in. inner diameter coolant tube concentric with the long axis; reflector cells do not have the central channel. The cans are fabricated of Hf-free unalloyed Zr sheet, 0.035 and 0.100-in. thick. Top and bottom adapter plates of stainless steel are attached for structural purposes. A pump-out tube and a breather tube pierce the upper can head and adapter plate. The development program for these cans included establishing fabrication procedures, welding techniques and sequences, testing of full size assemblies, and extensive investigation and testing of the can head structure. The moderator cans are subject to thermal cycling in the reactor with the result that the can head coolant tube joint is severely stressed. A thorough stress analysis was performed to guide the design of this joint. A series of model tests was also conducted, using the "Stress-Coat" technique to study actual stress patterns. From the results of can head flexure tests performed in Na under simulated reactor operating conditions, it is estimated that the probable service span of the final design of this joint is at least as great as the expected can life. Several other tests are described, including outgassing of graphite, Na vapor ingestion by the breather tube, and Na flooding of a full-size can. (auth)

4457 NAA-SR-2134

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR KINETICS QUARTERLY PROGRESS REPORT [FOR] OCTOBER–DECEMBER 1956. M. E. Remley, ed. Jan. 15, 1958. 55p. Contract AT-11-1-GEN-8. $1.50 (OTS).

The KEWB I reactor was operated at its design power of 50 kw. Investigation of the energy coefficient of radiolytic-gas production shows the rate of gas evolution to be linearly decreasing with increasing reactor core pressure. Experimental transient studies with initial core temperature and initial core pressure as parameters result in lower peak reactor powers with both increased core temperature and decreased core pressure. The radiolytic-gas evolution is found to play a dominant role in reactor shutdown, but the effectiveness of the gas as a shutdown mechanism cannot be predicted by assuming that gas bubbles instantaneously contribute to reactivity compensation. The power and temperature transfer functions for a water boiler reactor are obtained for the case of m groups of delayed neutrons including the effects of temperature and radiolytic-gas generation. The nature of the reactor transfer function is investigated, and a number of asymptotic and approximate expressions for the function are given. The derivation and limitations of the space-independent reactor kinetic equations are discussed briefly. (For preceding period see NAA-SR-1811.) (auth)

4458 NAA-SR-2287

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DEVELOPMENT OF THE OMRE CONTROL-SAFETY ROD. H. Strahl. Dec. 15, 1957. 34p. Contract AT(04-3)-88. $1.00(OTS).

A description of the control-safety rods for the OMRE (Organic Moderated Reactor Experiment) and the developmental testing of these rods are presented. The OMRE control-safety mechanism utilizes an electro-mechanical drive in conjunction with a rack and pinion for insertion or withdrawal of rods. The nuclear poison material consists of boron carbide powder compacted and sealed in AISI 4130 tubing. The twelve rods required are paired into six groups to reduce the number of drive units. Four groups are used for shimming action and have only a slow-speed drive. The other two groups can be used for either shimming or regulating action and have both slow-and fast-speed drives. The rods also function as safety rods by utilizing a quick-release mechanism. A prototype rod was tested under reactor operating conditions. Descriptions of the drive motor and gear assemblies, rack and pinion, scram release mechanism, snubbing action, rod guidance, and a discussion of materials compatibility are presented. (auth)

4459 NAA-SR-Memo-1935

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

OM TERPHENYL SUBSTITUTION FOR DIPHENYL IN THE OMRE. May 1, 1957. 14p. $3.30(ph OTS); $2.40 (mf OTS).

Changes in operational performance of the OMRE which might be expected as a result of changing the coolant-moderator from Diphenyl to OM Terphenyl are considered. The desire to initiate operation of the OMRE with OM Terphenyl stems primarily from the needs of the organic moderated power reactor program, in which the reference design presupposes the use of Santowax R as the moderator coolant. The principal advantage of Santowax R over Diphenyl in the OMR is the reduction in vapor pressure, thereby resulting in the design of a system which operates at a lower pressure. The advantages of a low pressure system are many fold, the principal ones being a reduction in system costs and a decrease in the amount of dissolved gas present in the system. While OM Terphenyl does not have the exact physical properties of Santowax R, their properties are sufficiently alike in the important variables (i.e., vapor pressure, viscosity, density) to make the study of the operational performance of OM Terphenyl closely correspond to a study of Santowax R. Furthermore, the fact should not be overlooked that irradiated Diphenyl containing moderate amounts of high boilers tends to look much like OM Terphenyl in these same important physical properties. Hence, the basic consideration between Diphenyl and OM Terphenyl is probably one of initial operation rather than that of long term operation where the irradiation effects indicated above tends to reduce the difference between the two systems. Discussed are the expected performance characteristics for unirradiated systems, the one being Diphenyl, the other OM Terphenyl. In general it will be noted that the differences obtained are not great, indicating that the substitution of OM Terphenyl for Diphenyl in the OMRE does not compromise the OMRE program objectives. (auth)

4460 NDA-14-116

Nuclear Development Corp. of America, White Plains, N. Y.

GAMMA FLUXES AT NEUTRON DETECTING INSTRU-

MENTS. L. Wills. Nov. 25, 1955. 7p. For Atomic Power Development Associates, Inc. $1.80(ph OTS); $1.80(mf OTS).

4461 NDA-14-127

Nuclear Development Corp. of America, White Plains, N. Y.

INTERPRETATION OF AN EXPERIMENT TO MEASURE DOPPLER EFFECT. G. Goertzel and C. Klahr. June 29, 1956. 21p. For Atomic Power Development Associates, Inc. $4.80(ph OTS); $2.70(mf OTS).

An experiment was devised for measuring the Doppler reactivity effect in fast reactor mockups operating at zero power. Calculations are developed which relate the experimental reactivity values obtained in this manner to the actual Doppler temperature coefficient in a hot reactor operating at full power. (D.E.B.)

4462 NDA-Memo-14-92

Nuclear Development Associates, Inc., White Plains, N. Y.

ACTIVATION OF SODIUM COOLANT. H. Yamauchi. June 22, 1955. 3p. For Atomic Power Development Associates, Inc. $1.80(ph OTS); $1.80(mf OTS).

4463 ORNL-2432

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 31, 1957. Jan. 21, 1958. 207p. Contract W-7405-eng-26. $5.50(OTS).

Operational experience gained from HRT startup runs is discussed. Reactor component testing was continued; results are given. Additional performance information was gained in test operations of the fuel processing plant. Criticality studies of various core geometries and fuel and blanket compositions were made in connection with HRE-3 design. The development of homogeneous reactor fuel, blanket, and instrumentation systems was continued with studies of materials corrosion and radiation effects and solution and slurry stability. Basic metallurgical studies of metals and alloys for possible use in homogeneous reactors were continued. Chemical and chemical engineering studies directed toward improved fuel and blanket processing are reviewed. (For preceding period see ORNL-2379.) (D.E.B.)

4464 TID-7549(Pt. I)

American Nuclear Society, Oak Ridge, Tenn.; Atomic Industrial Forum, Inc., New York; and Atomic Energy Commission, Washington, D. C.

REACTOR SAFETY CONFERENCE [HELD AT] NEW YORK CITY, OCTOBER 31, 1957. 45p. $0.75(OTS).

Papers are included on AEC licensing policies and procedures with regard to reactor safety, technical requirements for an AEC safeguards report, the AEC reactor safety experimental program, and the role of the Advisory Committee on Reactor Safeguards. (M.H.R.)

4465 UCRL-4998

California. Univ., [Livermore.] Radiation Lab.

PULSED NEUTRON EXPERIMENTS WITH FAST ASSEMBLIES. Joel Bengston and Lawrence Passell. Oct. 31, 1957. Decl. Nov. 25, 1957. 11p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40(mf OTS).

This is a slight revision of the paper presented at the Theoretical Reactor Physics Conference in Sun Valley, Idaho on Sept. 25, 1957.

The pulsed source technique consists of introducing repeated short bursts of neutrons into a subcritical assembly, and following the decay of the leakage flux as a function of time. This technique is shown to be complementary to the "Rossi alpha" method, being more satisfactory than the latter for slower systems and further from prompt critical. The normal mode decay constants for a number of bare subcritical highly enriched assemblies thus obtained serve as additional normalization data for multigroup cross-sections. Analysis of the data for a set of enriched U spheres indicates that a satisfactory fit cannot be obtained with one group constants, and that the neutron spectrum is slower for smaller assemblies. It is noted that plotting the decay constant as a function of buckling gives an apparently accurate way to extrapolate to prompt critical. The pulsed source technique can also be used to calibrate control rod and poison worth, and will give some estimate of the prompt neutron lifetime. (auth)

4466 WAPD-B(H)-429

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

REGULATING ROD DRIVE MOTOR AND HOUSING. B. W. Hatten. May 22, 1952. Decl. Mar. 19, 1957. 10p. $3.30 (ph OTS); $2.40(mf OTS).

The regulating rod drive mechanism is actuated by a synchronous reluctance type linear electric motor located inside a tubular housing mounted on the head of the pressure vessel. The motor is partially submerged in primary coolant, but the windings are isolated from the water by means of seal welds. The moving part of the motor is called the rotor, although it actually moves in translation only. Motion is produced as the rotor seeks to follow the linear displacement of a magnetic field in exactly the same manner as the shaft of the shim rod drive motor follows a rotating field. The length of stroke of the rotor is $\pm 2\frac{3}{4}$ in. about the neutral position; means are available, however, for increasing the amplitude to ± 3 in. The motion of the rotor is directly transferred to the regulating rod through an interposed connecting rod. While the connecting rod is permanently bolted to the regulating rod, the rotor is attached to the connecting rod by a bayonet type joint which permits connection or disconnection between these two parts as desired. (auth)

4467 WAPD-CTA(MEE)-126

[Westinghouse Electric Corp.] Bettis Plant, Pittsburgh.

REPORT ON HEAT-LOADING OF HOT WOUND INCONEL-X CORE BLANKET SPRINGS. J. V. Alger. Apr. 3, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

Heat-loading, prior to service exposure, was proposed to increase load relaxation resistance of hot-wound core blanket springs designed for the Pressurized Water Reactor. The heat-loading treatment recommended is not only beneficial but necessary for these springs in this application if minimum service relaxation is to be expected. Some permanent deformation will occur if springs of this material and dimensions are loaded to 1775 pounds when installed. This cold work should be allowed to recover. After the recommended treatment the springs can be installed by compressing with a 1775 pound load without further cold work and subsequent relaxation because of it. The recommended treatment is outlined. (M.H.R.)

4468 WAPD-EM-185

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A RESONANT NETWORK TO MINIMIZE LOW-FREQUENCY ATTENUATION. P. S. Nissenson. Apr. 23, 1953. Decl. Mar. 19, 1957. 7p. $1.80(ph OTS); $1.80 (mf OTS).

Since the speed of travel of the control rods in in./min depends upon the "frequency" of the low-frequency power supplied to the canned motors, it was assumed that to increase the speed of the control rod travel, it was simply necessary to increase the speed of the commutating and reversing switches. However, a severe attenuation of generator output voltage occurs with a frequency increase

even at the low range from zero to 2 cps. Methods of correcting this attenuation are discussed. (M.H.R.)

4469 WAPD-FE-83

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

REPORT ON PWR EXPERIMENT 11c3: THE EFFECT OF CLAD THICKNESS ON ROD TYPE ELEMENTS. J. Halapatz. Aug. 27, 1954. Decl. Mar. 19, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

Described is the experimental fabrication by extrusion of nominal 0.5 in. diameter fuel-bearing rods containing 10% Zr-U cores with nominal Zircaloy-2 clad thicknesses of 0.020, 0.039, 0.054, and 0.076 in. The most uniform core configuration and composite geometry was indicated for rods with the nominal clad thickness of 0.020 in. Poor composite geometry and unacceptable core dimensioning was obtained for the heavier clads. Rod sections of each of the clad thicknesses will be corrosion tested to observe the effect of type of failure. (auth)

4470 WAPD-M-44

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PWR FUEL ELEMENT DEVELOPMENT PROGRAM. Lloyd B. Kramer, ed. Nov. 24, 1953. Decl. Mar. 12, 1957. 48p. $9.30(ph OTS); $3.60(mf OTS).

Two classes of high U alloys are known to possess superior corrosion resistance to high temperature water. These are the γ-phase stabilized alloys typified by the U–Mo class and the α-phase alloys of which a 3% Nb in U composition is an example. The former type probably possesses adequate corrosion resistance (at least for a 3000 hr core) and can probably be developed so as to exhibit suitable corrosion resistance for even longer periods. It suffers the disadvantage of introducing a large amount of poison into the system since at present 8 to 9 wt. % Mo is the minimum required. The latter type is more desirable in regard to cross-section but shows insufficient corrosion resistance for the Shippingport Pressurized Water Reactor (PWR) application since the maximum temperature of usefulness is limited at present to 500°F. Both types of alloys are benefited when restrained in claddings. By suitable combination of proper cladding technique and judicious selection of ternary addition elements, it is believed that the prospects for development of a core alloy showing adequate corrosion resistance at an acceptable poison level through defects in the claddings under PWR operating conditions are quite good. (auth)

4471 WAPD-P-695

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

ANALYSIS OF DCTF CRITICALITY AND REACTIVITY DATA. Ely M. Gelbard. Dec. 1955. 18p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

DCTF (Danger Coefficient Test Facility) critical heights were measured for six different concentrations, both with and without a water reflector. In addition, reactivities per inch of solution height have been determined for the same concentrations. This report summarizes results of an investigation of the experimental data, an investigation which had two main objectives. First, it was hoped that available information would suffice to determine lucite and water reflector savings for the given fuel concentrations. Second, the moments of the slowing down density in water were to be deduced from the critical height and reactivity measurements, through analysis of the critical equation. The results detailed were inconclusive, but suggestive. (auth)

4472 WAPD-PWR-PCR-498

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

REACTOR PLANT SIMULATOR STUDIES— PWR PROJECT. [Period covered] February to August 1957. E. A. Wieczorkowski. 51p. Contract AT-11-1-GEN-14. $9.30(ph OTS); $3.60(mf OTS).

Results of simulator studies are presented together with a summary of the most significant results from these studies. Thirty-four simulator recordings which are representative of the types of transients analyzed are included. Types of studies included are: maximum design limit load changes, start-up accidents, continuous rod withdrawal during power operation, power and temperature controller response (Xe buildup), cold water accident, and loss of flow accidents. The primary coolant and steam loops were simulated for all studies except the loss of flow accident studies. The four primary loops were simulated as one loop by lumping the four loop parameters. The loss of flow studies were conducted with just the core simulated. Both three loop and four loop flow conditions were studied. Simulating just the core places no restriction on the results of the loss of flow studies because the transients are very rapid and the phenomena of interest are realized in less than the loop transit time. (auth)

4473 WAPD-PWR-Ph-152

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PWR MOCK-UP EXPERIMENTS— I. W. H. Hartley. Dec. 1956. 42p. $7.80(ph OTS); $3.30(mf OTS).

Full-scale mock-ups of the Shippingport Pressurized Water Reactor (PWR) core were constructed to obtain an estimate of the excess and shutdown reactivities of the PWR. A preliminary measurement of the temperature coefficient of reactivity of one of the cores near room temperature was made. Measurements of vertical and horizontal flux distributions in various positions throughout a core were also made. The results of these investigations are presented. (auth)

4474 WAPD-T-288

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

FEASIBILITY STUDY OF A HETEROGENEOUS–HOMOGENEOUS NUCLEAR POWER REACTOR (thesis). Charles H. Randall. Oct. 1956. 39p. $13.80(ph OTS); $4.80 (mf OTS).

Submitted to the Univ. of Pittsburgh.

The commercial potential of the nuclear reactor concept described in Westinghouse Atomic Power Division Patent Disclosure 25,981 (Appendix I) is evaluated. The two-region reactor illustrated consists of a circulating fuel system and a fixed fuel lattice. A preliminary design developed from this idea was investigated. Its major advantages and disadvantages are discussed in the test. The results indicate that the design is feasible; but from its estimated performance it is not possible to claim obvious economic superiority. However, there are enough significant advantages evident to warrant further investigation of the scheme. A possible direction for this investigation is also discussed. (auth)

4475 WAPD-TM-87

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

SURFACE MODIFIED NUCLEAR OPTICAL MODEL: DESCRIPTION OF THE SUMNUM CODE FOR THE NORC COMPUTER. Harvey J. Amster and Linwood M. Culpepper. Oct. 1957. 20p. Contract AT-11-1-GEN-14. $0.75(OTS).

The optical model, which described the interaction of nuclei with neutrons as that of a single particle complex potential, correctly reproduces many experimental trends

found in neutron cross sections. The SUMNUM code calculates neutron cross sections from potentials with a square well core and an arbitrary function in the surface. (M.H.R.)

4476 WCAP-380

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

PERTURBATION THEORY CONTROL ROD WORTH. William Howard Arnold, Jr. Dec. 1956. 25p. $4.80(ph OTS); $2.70(mf OTS).

This paper was presented to the American Nuclear Society meeting in Washington, D. C. on Dec. 11, 1956.

A method is presented for the calculation of control rod worths by a combination of perturbation and transport theory. The perturbation theory finds the reactivity effect of absorber in the shape of the control rod. The transport theory calculates an effective absorption cross section for this absorber. One advantage of this scheme is that cruciform rods can easily be treated by transforming to a square reactor, in which case the rod boundaries are coordinate surfaces. Another advantage is that perturbation theory uses the simple diffusion solution in the unperturbed reactor where it is an excellent approximation; more rigorous methods can be used in the immediate vicinity of the rod surface. The use of perturbation theory restricts the method to rods which do not have an overwhelming worth, even though the flux dipping around the rod is accounted for in the calculation of an effective Σ_a. A useful approximation for the Δk of a cruciform rod, good when the rod is thin and small compared to the reactor dimensions, and black to thermal neutrons, is given. A similar expression is derived for the case in which the rod absorbs resonance as well as thermal neutrons. (auth)

4477 YAEC-51

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MONTHLY PROGRESS REPORT FOR DECEMBER 1, 1957. I. H. Coen and R. W. Garbe. Jan. 20, 1958. 13p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

Progress in the design and development of the Yankee Power Reactor and its components is briefly reviewed. (For preceding period see YAEC-49.) (D.E.B.)

4478

CONTROL OF NUCLEAR REACTORS. R. Vestergaard. Atomkern Energie 2, 445-51(1957) Nov.-Dec. (In German)

4479

CONSIDERATION OF AIR GAPS IN THE NEUTRON DIFFUSION THEORY OF A TWO-STAGE REACTOR. Dietrich Bünemann. Atomkern Energie 2, 452-6(1957) Nov.-Dec. (In German)

4480

THE PROBLEM OF CALCULATIONS FOR REFLECTED REACTORS USING FERMI AGE THEORY. Gerhard Locke. Atomkern Energie 2, 467-75(1957) Nov.-Dec. (In German)

4481

THE PLASMA REACTOR, A MEANS OF DIRECT GENERATION OF ELECTRICITY FROM NUCLEAR FISSION. Atomkern Energie 2, 490-4(1957) Nov.-Dec. (In German)

4482

BOILING WATER REACTORS. L. Roseo. Energia nucleare (Milan) 6, 447-66(1957) Dec. (In Italian)

The physical and hydrodynamical characteristics of boiling water reactors are reviewed first, and then the operating behavior of direct and dual cycle power plants. The effects of subcooling, of superheating, and of the radioactivity of primary steam are outlined. A short review of boiling water reactors in developmental stage or under construction in the world comes next; this list indicates that the use of boiling power reactors, although many problems remain to be solved, will increase in the future. (auth)

4483

THE SOVIET ATOMIC ENERGY PROGRAM. Energia nucleare (Milan) 6, 467-72(1957) Dec. (In Italian)

A modified translation of an official report delivered by the Soviet delegation at the 11th Partial Session of the World Power Conference held in Belgrade last June is given. Two types of atomic power stations are expected to be built in the USSR; in the first project reactors are moderated and cooled by pressurized water, in the second they are graphite-moderated and cooled by pressurized water and steam. The experimental program foresees the construction of several plants; a boiling water reactor, a sodium-graphite reactor, a fast breeder, and a homogeneous heavy water reactor. (auth)

4484

CREEP TESTS ON MATERIALS FOR GAS-COOLED REACTORS. NEW RESEARCH EQUIPMENT AT G.E.C. ATOMIC LABORATORIES. Metallurgia 56, 313-14(1957) Dec.

Research equipment designed to provide creep and stress-rupture data on metals and alloys in gaseous atmospheres at high temperatures and pressures has been installed. Valuable basic work has been done in investigating the properties of magnesium alloys, widely employed for fuel element cans, in carbon dioxide atmospheres. The design of the equipment is such that it is comparatively easy to adapt it for operation in other atmospheres. The machines now in use provide an efficient means of obtaining very rapidly a broad assessment of the suitability of materials for reactor service. (A.C.)

4485

NRU OPERATING. CONSTRUCTION COMPLETED AT CHALK RIVER. Nuclear Eng. 3, 19-25(1958) Jan.

The NRU is a high-flux materials-testing reactor which utilizes heavy water as moderator and natural uranium as fuel. A description of the reactor and associated facilities is given, along with various phases of its operation. (L.T.W.)

4486

ESTIMATION OF CHARGE LIFE FOR REACTORS WITH SMALL CORES. H. L. McMurray, A. V. Grimaud, and G. H. Hanson (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 3, 38-46(1958) Jan.

An expression for the charge life of a reactor is derived in terms of a model which assumes that enough uniformly distributed poison is always present to keep the reactor critical with control rods withdrawn. The burnout distribution is assumed to be constant and to be the same as at the end of the run, or to follow the calculated thermal flux distribution. Two group perturbation theory expressions for reactivity changes due to fuel burnout and uniform poison removal may then be equated and integrated under plausible simplifying restrictions to yield an expression for charge life in terms of calculable, or measurable quantities. (auth)

4487

THE DECAY OF FISSION PRODUCT ACTIVITY FOR CYCLIC OPERATION OF A REACTOR. James W. Butler and M. Grotenhuis (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 47-51(1958) Jan.

A brief study of fission product gamma-ray power as a function of time after shutdown for periodic reactor operation as compared to constant power operation is presented. The basic decay formula of Way and Wigner is used. (auth)

4488
THE APPLICATION OF REACTOR KINETICS TO THE ANALYSIS OF EXPERIMENTS. A. F. Henry (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 52-70(1958) Jan.

The conventional kinetics equations for reactors in which fuel is stationary are derived without approximation from the time-dependent transport equation. The utility of the precise form which results is discussed, first generally, then with reference to the detailed analysis of two typical experiments. It is shown that the analysis required for a precise interpretation of kinetics experiments can generally be made using the same techniques employed in the computation of criticality for stationary cases. (auth)

4489
HEAT TRANSFER IN HETEROGENEOUS CIRCULATING-FUEL REACTORS. H. F. Poppendiek and L. D. Palmer (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 3, 85-106(1958) Jan.

Radial temperature distributions within the cores of heterogeneous circulating-fuel reactors having elementary channel and circular pipe geometries are described mathematically; uniform and nonuniform radial volume-heat-source distributions are considered. Solutions for cores with uniform volume-heat source distributions are tabulated so that detailed radial temperature profiles can be determined within fuels which are being uniformly cooled at the core walls. A derivation is presented which describes the heat transfer within a reactor core when walls are being non-uniformly cooled along its length; volume heat sources also exist within the core walls and coolant. (auth)

4490
NUCLEAR REACTORS FOR SHIP PROPULSION. M. Muysken. Reactor Centrum Ned. 1, 81-6(1957) Dec. (In Dutch)

A description is given of several problems which are of concern in the application of nuclear energy to ship propulsion. A summary of reactors for this application is given. The main consideration is that of the spreading of radioactivity in the event of a collision. (T.R.H.)

4491
THEORY OF HETEROGENEOUS REACTORS. II. DISCONTINUITIES IN FLAT PLATE REACTORS. Kurt Meetz. Z. Naturforsch. 12a, 863-73(1957) Nov. (In German)

Nuclear Transformation

4492 UCRL-8040
California. Univ., Berkeley. Radiation Lab.
DISINTEGRATION OF HELIUM BY 300-MEV NEUTRONS (thesis). William H. Innes. Nov. 1957. 74p. Contract W-7405-eng-48. $12.30(ph OTS); $4.50(mf OTS).

An investigation of the inelastic and elastic reactions between high-energy neutrons and He nuclei was conducted with a cloud chamber filled with He and operating in a pulsed magnetic field of 21,700 gauss. Neutrons produced by bombardment of a ½-in. LiD target with 340-Mev protons in the 184-in. synchrocyclotron were collimated and passed through the 22-inch expansion cloud chamber, which was filled with He gas to a total pressure of 89.8 cm Hg. Exclusive of meson-producing reactions, the possible reactions are: Inelastic, $He^4(n,pn)t$, $He^4(n,d)t$, $He^4(n,2np)d$, $He^4(n,dn)d$, $He^4(n,2n2p)n$, $He^4(n,2n)He^3$; and Elastic, $He^4(n,n)He^4$. The total number of events, for incident neutrons above 160 Mev, was normalized to the interpolated n-He^4 total cross section at 300 Mev, and absolute cross sections for the various processes were established. Energy and angular distributions of the reaction products were compared with available theoretical predictions and other experiments. A few cases of meson production were noted. (auth)

4493 SCL-T-151
CROSS SECTION OF THE REACTION $He^3(n,p)$ FOR THE NEUTRON ENERGIES UP TO 25 k.e.v. (KILO ELECTRON VOLT) AND THE EXCITED He^4 LEVEL. A. A. Bergman, A. I. Isakov, Yu. P. Popov, and F. L. Shapiro. Translated by M. I. Weinreich from Phys. Inst. of P. N. Lebedev, Academy of Sciences, U. S. S. R. [nd]. 10p.

It is seen that, although the magnitude and trend of the $He^3(n,p)$ cross section are satisfactorily described by the presupposition of the presence of an 0^+ He^4 level, (situated below the bond energy of the neutron) yet the data concerning the existence and properties of such a level are rather contradictory. An extrapolation of the state characteristics of He^4 from the state characteristics of heavier nuclei would lead one to expect that the first excited level of He^4 ought to have a moment(um) of 1^- or 2^-, but not 0^+. The force of this argument cannot be overestimated, inasmuch as it is not backed up by any quantitative theory. An elucidation of the situation would be promoted by the following two procedures: A further refinement of the experimental data on the He^4 levels and the $He^3(n,p)$ reactions; an elaboration of a less phenomenological approach to the theory of this reaction. (auth)

4494
DISINTEGRATION OF THE C^{12} OF PHOTOGRAPHIC EMULSIONS INTO THREE ALPHA PARTICLES BY 340 Mev PROTONS. M. A. Samman. J. phys. radium 18, 77S-8S(1957) Nov. (In French)

4495
ON THE EXISTENCE OF LARGE INTENSITY MODULATIONS IN THE SPECTRA OF PROTONS FROM SOME NUCLEAR REACTIONS. L. Colli (Lab. CISE, Milano) and S. Micheletti. Nuovo cimento (10) 6, 1001-5(1957) Oct.

The spectra of particles were examined, mainly protons emitted in nuclear reactions explained by a direct interaction, (d,p) or (p,p'). The peaks in the proton spectra of heavy nuclei observed in these reactions can be looked upon as intensity modulations of the protons group corresponding to many levels of the residual nucleus, and not as proton groups from a single level. It is noted that such intensity modulations seem to have simple regularities throughout the periodic system. (M.H.R.)

4496
NUCLEAR CHARGE DISTRIBUTION IN THE FISSION OF URANIUM AND THORIUM WITH 13.6-Mev DEUTERONS. J. M. Alexander and C. D. Coryell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 1274-80(1957) Dec. 1.

Measurements have been made of independent fission yields and valley-to-peak ratios in 13.6-Mev deuteron fission and fast-neutron fission of U^{238} and Th^{232}. From these measurements the conclusion is drawn that deuteron capture precedes a large fraction of the deuteron-induced fission events. The primary distribution of yields along a mass chain can be adequately explained by the postulate of equal charge displacement with the same distribution curve found applicable in low-energy neutron fission, best results requiring a slightly greater tendency for neutron emission in the heavy fragments. (auth)

4497
NEUTRONS FROM THE He^3 BOMBARDMENT OF B^{10}
F. Ajzenberg-Selove (Boston Univ., Mass. and Brookhaven National Lab., Upton, N. Y.); M. L. Bullock (Boston Univ., Mass); and E. Almqvist (Chalk River Labs., Ontario, Can.). Phys. Rev. 108, 1284-8(1957) Dec. 1.

The neutron spectrum from the $B^{10}(He^3,n)N^{12}$ reaction

was studied at $\bar{E}(He^3)$ = 2.54 and 3.60 Mev by the method of proton recoils in nuclear emulsions. The Q value of the $B^{10}(He^3,n)N^{12}$ reaction was measured to be 1.46 ± 0.06 Mev. The mass of N^{12} is then 12.02255 ± 0.00007 amu. The data also indicate excited states of N^{12} at 1.06 ± 0.08, 1.56 ± 0.08, (1.97 ± 0.10), 2.35 ± 0.08, 3.18 ± 0.15, and 3.46 ± 0.15 Mev, in good agreement with the known levels of the mirror nucleus B^{12}. At $\bar{E}(He^3)$ = 2.54 Mev, the angular distribution of the ground state neutrons is isotropic within statistics in the center-of-mass system, while at $\bar{E}(He^3)$ = 3.60 Mev, the angular distribution is peaked forward: $I(0°)/I(140°)$ = 2.9 ± 0.7, in the center-of-mass system. (auth)

4498

$Li^7(p,n)$, $(p,p'\gamma)$, AND (p,γ) REACTIONS NEAR NEUTRON THRESHOLD. H. W. Newson, R. M. Williamson, K. W. Jones, J. H. Gibbons, and H. Marshak (Duke Univ., Durham, N. C.). Phys. Rev. 108, 1294-1300(1957) Dec. 1.

The $Li^7(p,n)$ total cross section was measured in detail from threshold to 2.5-Mev proton energy. Between 1.88 and 1.92 Mev the cross section follows the equation for a very broad 2^- resonance and for s-wave particles: $\sigma_{pn} = (5/2)\pi\lambda^2 x/(1+x)^2$, where $x = \Gamma_n/\Gamma_p = 1$ at 50 kev above threshold. The remainder of the cross section up to 2.35 Mev is fitted by this level and the 3^+ level at 2.25 Mev. The neutron reduced width exceeds that of the proton by a factor of about five for both the 2^- and 3^+ levels; this is surprising for the self-mirror nucleus Be^8. A small dip is observed just above neutron threshold in the yield of 478-kev γ rays from $Li^7(p,p'\gamma)$. The shape of these data support the assumption of the broad 2^- neutron producing resonance with $\Gamma_p > 0.5$ Mev. No anomaly is observed in the yield of Li capture γ rays at neutron threshold; the 2.10-Mev resonance in this reaction (which probably is due to a $3^\pm$ level) yields mainly 16-Mev γ rays leading to the 2.9-Mev $2^\pm$ level in Be^8. The ratio of 16 to 19 Mev gamma rays is $^3/_2$ at both 1.7- and 2.5-Mev proton energy. The behavior of the $Li^7(p,n)$ extrapolated threshold was calculated as a function of target thickness and proton energy spread; shifts in the extrapolated thresholds and the distances between them and true threshold were less than one kev. The extrapolated threshold of a $^1/_2$-kev target taken with a proton energy spread of 1 kev was observed to be $^1/_2$ kev lower in proton energy than a thick-target threshold. (auth)

4499

TRANSMUTATION OF NITROGEN BY PROTONS FROM 100 kev TO 135 kev. William A. S. Lamb and Ross E. Hester (Univ. of California, Livermore). Phys. Rev. 108, 1304-7(1957) Dec. 1.

A portion of the excitation curve of the thermonuclear reaction $N^{14}(p,\gamma)O^{15}$ was measured using protons of 100 to 135 kev. The cross section of this reaction ranges from (8.5 ± 3.7) × 10^{-12} b at 100 kev to (1.4 ± 0.3) × 10^{-10} b at 135 kev. The approximate constant S_0 is defined by $S_0 = E\sigma \exp(31.281 Z_p Z_n A^{1/2} E^{-1/2})$, where E is the energy in the center-of-mass system and is measured in kev, σ is in barns, A is the reduced mass of the interacting nuclei, and Z_p and Z_n are the nuclear number of protons and nitrogen, respectively. Based upon these measurements, S_0 = 2.7 ± 0.2 kev-b. (auth)

4500

INTERACTIONS OF 1.3-Bev NEGATIVE PIONS IN NITROGEN. G. D. Gordon, R. H. Milburn, J. C. Street, and L. A. Young (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 1315-21(1957) Dec. 1.

Seventy-four inelastic pion-nitrogen interactions were studied using a diffusion cloud chamber provided with a magnetic field. Distributions have been made of the momenta, emission angles, and charges of the various nuclear and mesonic fragments, including a number of neutral pions and a hyperon, from these interactions. It is found that the induced excitation of the nitrogen nucleus can lead to a breakdown into from two to seven charged nuclear fragments. Evidence for multiple pion scattering within single nuclei is discussed. (auth)

4501

ENERGY SPECTRUM OF CHARGED PIONS FROM 2.2-Bev PROTONS ON Be. F. L. Niemann, J. K. Bowker, W. M. Preston, and J. C. Street (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 1331-40(1957) Dec. 1.

Nuclear emulsions were exposed to the radiations produced by 2.2-Bev protons incident upon an internal Be target in the Brookhaven Cosmotron. Particles were identified and their energies determined by grain counts and multiple scattering measurements. Approximately 100 pion tracks were studied at each of three laboratory angles, 12°, 18°, and 36° with respect to the direction of the incident beam. Assuming a simple nucleon-nucleon interaction in the target, these data correspond to spectra near 30, 50, and 90° in the center-of-mass system of two nucleons. Over this 30 to 90° angular range, the portion of the spectrum near 100 Mev is roughly isotropic, while in the 200- to 300-Mev range it is strongly anisotropic. A comparison of these and other results with recent calculations based on the isobar model reveal certain basic inconsistencies. The observed angular distributions appear qualitatively to be more in agreement with those to be expected from the statistical theory modified to include the final-state particle interactions and the conservation of angular momentum. (auth)

4502

STUDY OF THE $T(p,n)He^3$ AND $Li^7(p,n)Be^7$ REACTIONS. R. L. Macklin and J. H. Gibbons (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 105-9(1958) Jan. 1.

Absolute total (p,n) cross sections for the $T(p,n)He^3$ and $Li^7(p,n)Be^7$ reactions have been remeasured from threshold to 2.4 Mev, with special attention to the cross section near threshold. The $T(p,n)He^3$ total cross section follows the behavior expected from either direct interaction or Breit-Wigner analysis over most of the range studied. Departure from predicted behavior occurs below E_p(lab) = 1.10 Mev. The $Li^7(p,n)Be^7$ cross section can be fitted over the entire energy range studied by assuming a broad 2^- resonance near threshold, a 3^+ resonance at 2.25 Mev, and a small reaction background due to distant l = 1 resonances. The usual assumption of equal reduced widths for neutron and proton, however, cannot be used. Data for both reactions extrapolate to the values determined by reciprocity from the inverse reactions with thermal neutrons. (auth)

4503

THE REACTION $^3He(d,p)^4He$ BETWEEN 100 kev AND 500 kev. D. L. Booth, R. S. Hill, F. V. Price, and D. Roaf (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) A70, 863-5(1957) Dec.

The cross section of the reaction $He^3(d,p)He^4$ has been investigated between 100 and 500 kev deuteron energy, using a thin gas target. No significant anisotropy was found up to 500 kev. The total cross sections σ at deuteron energies E_d assuming isotropic angular distributions are given. (auth)

4504

ENERGY AND ANGULAR DISTRIBUTION OF NEUTRONS EMITTED IN THE Be^9 (d,n) B^{10} REACTION. A. I. Shpetnyi (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 5, 357-64(1957) Oct.

The energy spectra and angular distributions of neutrons from the $Be^9(d,n)B^{10}$ reaction have been investigated at deuteron energies of 0.5, 0.8, 1.0, 1.2, 1.4, and 1.6 Mev.

The excitation curve for this reaction indicates a resonance at 1 Mev in the compound nucleus, B^{11}. The angular distribution corresponding to an excited state in B^{10} with excitation energy E_x = 3.62 Mev points to the existence of a stripping mechanism. The angular distributions of reactions involving the formation of compound nuclei are appreciably distorted on passage through a resonance. (auth)

Particle Accelerators

4505

IMPROVEMENTS FOR A NH_3 MASER. J. Bonanomi, J. De Prins, J. Hermann, and P. Kartaschoff. Helv. Phys. Acta 30, 492-4(1957). (In French)

4506

POSSIBILITIES OF FOCUSSING IN A LINEAR ACCELERATOR WITH THE AID OF TRAVELING WAVES. V. S. Tkalich (Academy of Science, USSR). Soviet Phys. JETP 5, 518-19(1957) Oct.

Radiation Absorption and Scattering

4507 AERE-T/R-2218

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ESCAPE OF GAMMA RADIATION FROM URANIUM RODS IN A PILE. HEAT EVOLVED IN THE MODERATOR. J. S. Story. 1949. Decl. Aug. 1956. 47p.

When a U rod is irradiated in a pile, some energy is released in the form of gamma radiation. The fraction of this gamma-ray energy absorbed in the U at various photon energies is computed. A correction is made to allow for nonuniform source strength across the rod. The results, shown graphically for rods of two different diameters, are used in formation of a table displaying which fractions of the total fission energy escape from the U-rod before being converted into heat. (auth)

4508 NARF-57-59T

Convair, Fort Worth, Tex.

MONTE CARLO CALCULATION OF ENERGY ABSORPTION FROM NEUTRONS AND GAMMAS BY DISK-SHAPED SAMPLES. R. L. Johnston. Dec. 9, 1957. 35p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-179).

A Monte Carlo technique has been employed to calculate the energy lost by photons and elastically scattered neutrons in penetrating disk-shaped samples of nine light elements most commonly found in organic materials. In general, the results agree within a factor of 2 with values obtained by other methods. The effect of spectral shape, sample thickness, and density are illustrated. The details of the computer program together with extensions and improvements are discussed. (auth)

4509 NARF-57-60T

Convair, Fort Worth, Tex.

Co^{60} GAMMA DOSE MEASUREMENTS INSIDE CYLINDRICAL SHIELDS. D. G. Anderson. Dec. 16, 1957. 21p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-172).

The transmission and attenuation of air and ground scattered gamma radiation through cylindrical crew shields has been investigated to provide information for the evaluation of calculational techniques. Gamma dose rates were measured along the centerline of two cylindrical crew shields of identical shapes, one half the size of the other. The larger cylinder corresponded in size to the engineered crew shield. Various side-wall rubber thicknesses, shadow shield angles, and source-detector separation distances were investigated for both cylinders. Measurements were made for air and ground scattered gamma radiation. The results of this investigation indicate that cavity size is not an important factor in crew shield penetration. (auth)

4510 NEVIS-48

Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.

SCATTERING OF 80 MEV π^- MESONS BY COMPLEX NUCLEI (thesis). Winslow F. Baker. Mar. 1957. 58p. Contracts N6-ori-110, Task No. 1 and AT(30-1)-1932. (CU-137-57-ONR-110-1-Phys.). $9.30(ph OTS); $3.60 (mf OTS).

The elastic scattering of 80 Mev π^- mesons by lithium, carbon, aluminum, and copper has been investigated using a new π^- detector which gives greatly improved discrimination against low energy-loss inelastic events. A "transmission" scatterer orientation was necessary to maintain energy resolution, so only less than 120° scattering was studied. The new differential scattering cross sections for lithium, aluminum, and copper agree with previously reported results at small angles but are 2 to 10 times smaller at larger angles. There are indications of diffraction structure in aluminum and copper which were not previously observed due to the poorer energy resolution of the earlier measurements. Including the incident beam energy spread, the detector sensitivity is down by factors of 3 and 9 for E ± 5.0 Mev and E ± 10 Mev when peaked for mean energy E. This was used to separate the scattering from carbon into elastic and inelastic components for excitation of the 4.43 and the (7.65 and 9.61) Mev levels. Inelastic scatterings from lithium have also been studied. A comparison is made between the inelastic meson scattering results and the inelastic scattering of other particles, particularly electrons. The elastic scattering is compared with the results of complex square well phase shift calculations. (auth)

4511

MOLECULAR BONDS AND THE STOPPING OF ALPHA PARTICLES IN GASES. R. Riskalla and J. Rossel. Helv. Phys. Acta 30, 488-91(1957). (In French)

For simple gases such as O_2, H_2, CO_2, CH_4, the law of additivity of powers for relative stopping in air is a sufficiently precise method (error 72%) for rapid determination of alpha particle energies beginning with distance traveled extrapolated in air for energies higher than 3 Mev (corresponding to 750 Kev protons). Below this energy appreciable deviations appear, of the order of 10% already for E = 2.5 Mev. For more complex molecules, C_4H_{10}, deviations from the additivity law are already very sensitive to energies E_α of 5.3 Mev (13%), the calculated stopping power being higher than the actual stopping power. (tr-auth)

4512

ON POLARIZATION EFFECTS IN COULOMB ELECTRON SCATTERING. G. Passatore. Nuovo cimento (10) 6, 850-63(1957) Oct.

Polarization effects in Coulomb electron scattering are considered by using Stokes parameter technique. As four real parameters completely describe the intensity and the polarization of a beam, the transition probability is expressed by a T-matrix which operates on them and the general relation expressing the T-matrix in terms of the S-scattering matrix is then deduced. The T-matrix connecting the Stokes parameters of the scattered beam with those of the incident one is obtained in Born's first approximation. As is well known, in this approximation there are no polarizing effects, but it becomes easy to discuss explicitly the spin direction dependence on the scattering an-

gle. The T-matrix expression for a general spherical field is then obtained without using Born approximation. Some general features, and in particular the polarizing effect, are discussed. (auth)

4513

POTENTIAL INELASTIC SCATTERING BY COMPLEX NUCLEI. A. Tomasini. Nuovo cimento (10) 6, 927-36(1957) Oct.

It is shown that there exists an inelastic scattering of any type of particle by complex nuclei, due essentially to the perturbation produced by the incident particle on the over-all potential experienced by the nucleons of the nucleus. A particle which enters a nucleus and goes out without being captured, determines an increase or a decrease of the over-all potential, during the short time it is inside the nucleus; so that the nucleus can make a transition to an excited level. It is shown that the anomalous inelastic scattering of 23 Mev (and 18 Mev) protons by intermediate and heavy nuclei, should be due to such a type of excitation; all quantitative features of the process are well explained, and also the quantitative results are in agreement, in spite of the crude approximations made. (auth)

4514

NUCLEAR ELASTIC SCATTERING OF 2 Mev POSITRONS IN ARGON. C. Giori and C. Succi. Nuovo cimento (10) 6, 937-45(1957) Oct. (In Italian)

The nuclear elastic scattering of the positrons of energy about 2 Mev has been analyzed by means of a diffusion cloud chamber. A total length of 7,762 m was measured in about 24,500 photographs. The total number of scatterings $\geq 20°$ is 580 with 183 deflections greater than 30°. The comparison between experimental and theoretical data obtained by applying the method of the projected tracks, has shown a good agreement with the angular distribution of scattering as predicted by the quantum theories. (auth)

4515

ASYMPTOTIC EXPANSION FOR HIGH-ENERGY POTENTIAL SCATTERING. J. J. Tiemann (Stanford Univ., Calif.). Phys. Rev. 109, 183-8(1958) Jan. 1.

An asymptotic expansion of a previously derived approximate expression for high-energy potential scattering is obtained. This is used to compute numerical values for the large-angle differential scattering cross section of a Schrödinger particle scattered by a spherically symmetric parabolic potential well and of a relativistic electron scattered by a uniformly charged sphere. In both cases the parameters are such that the Born approximation cannot be used. These values are compared with the results of an exact partial wave calculation and (in the parabolic-well case) with the results of numerical integration of the full approximation expression. The object of this work is to gauge the reliability both of the full approximate expression, and of its asymptotic expansion. It is found that for both the Schrödinger equation and the Dirac equation the locations of the maxima and the minima of the scattering cross sections are reproduced with good accuracy. The magnitudes of the minima, however, are not given reliably and although the general shapes of the curves are correct, the magnitudes of the maxima differ from the correct values by 10 to 50%, depending on the value of kR. (auth)

4516

DISPERSION RELATIONS FOR DIRAC POTENTIAL SCATTERING. N. N. Khuri and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 109, 198-208(1958) Jan. 1.

Dispersion relations for scattering of a Dirac particle by a potential are shown to hold for a broad class of potentials. In contract to the field theoretic case, the derivation here makes no use of the concept of causality but is instead based directly on the analytic properties of the Fredholm solution of the scattering integral equation. It is shown that the scattering amplitude, considered as a function of energy and momentum transfer, can be extended to a function analytic in the complex energy plane, for real momentum transfer. The dispersion relations then follow in the standard way from Cauchy's theorem. The final results involve one "subtraction." It is also shown that the analytic continuation into the unphysical region for nonforward scattering can be carried out by means of a partial wave expansion. (auth)

4517

ANGULAR DISTRIBUTIONS OF SOME INELASTICALLY SCATTERED DEUTERON GROUPS FROM ^{24}Mg AND ^{28}Si. S. Hinds, R. Middleton, and G. Parry (Univ. of Liverpool). Proc. Phys. Soc. (London) A70, 900-2(1957) Dec.

Angular distributions have been measured of some groups of deuterons inelastically scattered by Mg^{24} and Si^{28}. These distributions were obtained at a bombarding energy of 8.9 Mev. A natural target of magnesium was used in the reaction $Mg^{24}(d,d')Mg^{24}$. A quartz target (SiO_2) was used for an investigation of the Si^{28} reaction. (A.C.)

4518

ABSORPTION OF BETA PARTICLES IN LIQUIDS. S. Abid Husain and A. K. Hilmi. Proc. Phys. Soc. (London) A70, 902-4(1957) Dec.

Beta particles passing through matter lose energy by ionizing and exciting the atomic electrons. This energy loss is a function of electron density. The authors have shown that the loss of energy of beta particles depends also on the atomic number because, due to nuclear collisions, the path length in the absorber is increased. The absorption of beta particles in organic liquids was studied in order to see how far they show this effect. (A.C.)

4519

ELASTIC AND QUASI-ELASTIC SCATTERING OF 660 Mev PROTONS BY DEUTERONS. G. A. Leksin (Joint Inst. for Nuclear Research). Soviet Phys. JETP 5, 371-7(1957) Oct.

The differential elastic p–d scattering cross sections at angles of 40° to 150° and the differential quasi-elastic p–p scattering cross sections at angles of 50° to 90° of the two nuclei were measured in the center of mass system by the ganged-telescope method. The experimental data point to the existence of a predominant interaction between the incident proton and the separate nucleons in the deuteron and also to the existence of collective interactions between the three nucleons. The energy dependence of the differential cross section of quasi-elastic p–n scattering into an angle of 90° in the c. m. s. of the two nucleons was also measured in the 460 to 660 Mev range. (auth)

4520

ELASTIC SCATTERING OF 360 Mev POSITIVE π-MESONS BY PROTONS. N. A. Mitin and E. L. Grigor'ev (Joint Inst. for Nuclear Research). Soviet Phys. JETP 5, 378-81(1957) Oct.

Photographic plates were used to study the angular distribution of 360 ± 10 Mev π^+ mesons elastically scattered by protons. The differential cross sections derived from 218 scattering events for SP analysis and for SPD analysis are given. The phase shifts which correspond to these distributions are also given. (auth)

4521

ON THE ABSORPTION OF HIGH ENERGY NUCLEAR-ACTIVE PARTICLES. S. Z. Belen'kii and N. M. Gerasimova (Academy of Sciences, USSR). Soviet Phys. JETP 5, 456-9(1957) Oct.

The propagation of nuclear-active particles in matter is computed from the cross sections for the elementary collision act, obtained on the basis of the hydrodynamic theory of multiple particle production. (auth)

4522

INELASTIC PROTON-PROTON SCATTERING. Iu. I. Kulakov (Moscow State Univ.). Soviet Phys. JETP 5, 477-82(1957) Oct.

The problem of inelastic proton-proton scattering at 690 Mev is considered. It is assumed that in the intermediate state an isobar is formed which decays into a nucleon and π meson. Limiting the consideration to isobars in S-states, using the laws of conservation of angular momentum and parity, and taking into account the Pauli principle, it was found possible to obtain the angular distribution of scattered nucleons, with the introduction of only one arbitrary constant. (auth)

4523

RECONSTRUCTION OF THE SCATTERING MATRIX OF A TWO-NUCLEON SYSTEM. L. Puzikov, R. Ryndin, and Ia. Smorodinskii (United Inst. for Nuclear Studies). Soviet Phys. JETP 5, 489-95(1957) Oct.

The types of experiments needed for determination of all elements of the scattering matrix are investigated. It is shown that because of the unitarity condition the required number of experiments equals the number of complex functions entering into the scattering matrix. For nucleon-nucleon scattering, the inelastic scattering matrix can be determined on the basis of five experiments measuring the cross section, polarization, normal components of the polarization correlation tensor and of the triple scattering tensors (for the scattered and recoil particles). It is shown that experiments involving spin rotation by a magnetic field are not necessary for a phase shift analysis. (auth)

4524

ENERGY DEPENDENCE OF THE EFFECTIVE CROSS SECTION OF INELASTIC SCATTERING OF PARTICLES NEAR THE THRESHOLD. G. F. Drukarev (Leningrad State Univ.). Soviet Phys. JETP 5, 496-7(1957) Oct.

Radiation Effects

4525 AD-129490

Haller, Raymond and Brown, Inc., State College, Penna.

IRRADIATION OF TRANSISTORS IN A THERMAL FISSION REACTOR SPECTRUM. Robert D. Laughlin and Robert L. Riddle. Apr. 19, 1957. 40p.

The over-all performance of a combined crystal detector and transistor amplifier was measured as affected by radiation in the Pennsylvania State University Research Reactor. Another series of experiments with a similar amplifier, the same crystal detector, six single transistors, and some resistors and magnetic tape is described and discussed. (T.R.H.)

4526 NARF-57-52T

Convair, Fort Worth, Tex.

EFFECTS OF REACTOR RADIATION ON THE ELECTRICAL PROPERTIES OF ELECTRONIC COMPONENTS. PART II. VACUUM TUBES, TRANSISTORS AND TRANSFORMERS. P. S. Miglicco, A. B. Spears, and D. B. Howell. Nov. 22, 1957. 116p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-173).

Part I issued as NARF-56-6T.

Several types of vacuum tubes, transistors and transformers were irradiated with the Convair-Fort Worth Ground Test Reactor. The components were subjected to five different fluxes ranging from 10^6 to 10^{10} n_F/cm^2-sec and 10^8 to 10^{12} γ/cm^2-sec. The total integrated flux received was 10^{14} n_F/cm^2 and 10^{16} γ/cm^2. An attempt was made to separate radiation damage as a function of dose rate from radiation damage as a function of dose. The components were irradiated first at several low dose rates so that dose rate effects could be studied while the accumulated dose was small, and then at a high dose rate to obtain the desired dose. However, because of the long time required to complete a data gathering cycle, the accumulated dose hindered the separation of dose rate and dose effects. Thus, in the report, the damage to the components is reported as a function of integrated flux. For reference, the integrated flux accumulated at each power level is given. The transformers exhibited the greatest resistance to irradiation. Every important parameter of the transistors deteriorated in the radiation field. Postirradiation tests at room temperature showed no significant recovery in the transistor's characteristics. The plate current of 65% of the tubes tested increased during irradiation. This effect, based on postirradiation tests, is considered permanent. (auth)

4527 NARF-58-1T(Add. 1)

Convair, Fort Worth, Tex.

RESULTS OF SYSTEM PANELS TEST NUMBER 2, ADDENDUM 1. Jan. 6, 1958. 157p. Project 6(1-9964). Contract AF33(600)-32054. (FZK-9-126-1).

The results of irradiating five test panels supplied by Pratt and Whitney are presented. The panels contained a J-57 engine, a hydraulic pump loop, various types of transducers and electronic control components, an alkylbenzene pump loop, and fuel control units, power supplies, and amplifiers. Metallic sub-assemblies and individual parts showed no apparent damage. Performance of some components changed as a result of teflon embrittlement and deterioration. Methyl alcohol proved to be an unsatisfactory fluid for use in a turbojet fuel-control temperature-sensing assembly. Transistors and silicon diodes failed. Electronic components using current production capacitors, resistors, and vacuum tubes showed negligible effects. (M.H.R.)

4528 NP-6540

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ELECTRICAL LEAKAGE IN INSULATORS EXPOSED TO A NUCLEAR ENVIRONMENT. G. E. Lamale and P. Schall. Jan. 15, 1958. 5p. Project No. 2133. Contract AF33(616)-5171.

Radioactivity

4529

ABNORMAL RADIATION FROM CERTAIN RADIOELEMENTS. Marie Ader. Ann. phys. 2, 611-30(1957) Sept.-Oct. (In French)

Photographic emulsions exposed to solutions of salts of Po, Th, Ac, Ra, active deposits on various heavy metals of the same elements as well as of Radium D, Pu, and U metal, register, in addition to known radiation, some tracks of rays with abnormal lengths. These tracks have a length exceeding 300μ in a photographic plate corresponding to 60 cm in air. (tr-auth)

4530

INVESTIGATION OF RADIOACTIVE FALLOUT. Walther Gerlach, Ilse Zeising, and Klaus Stierstadt. Atomkern Energie 2, 438-43(1957) Nov.-Dec. (In German)

An investigation was made of the amount of radioactive fall-out present in rain, snow, dew, hoarfrost, etc., at various places for various months of the years 1956-1957. (J.E.D.)

4531

ION EXCHANGE PROCESS FOR THE MEASUREMENT OF β-ACTIVITY IN RAIN. A. Hinzpeter. Naturwissenschaften 44, 611-12(1957). (In German)

4532
DETERMINATION OF ELECTRON POLARIZATION BY ELECTRON-ELECTRON SCATTERING: Y^{90} and Au^{198}. N. Benczer-Koller, A. Schwarzschild, J. B. Vise, and C. S. Wu (Columbia Univ., New York). Phys. Rev. 109, 85-9 (1958) Jan. 1.

The polarization of the β particles from Y^{90} and Au^{198} has been investigated by using electron-electron scattering. The reliability of this method and the precautions necessary in its application are discussed. It was found that for both Y^{90} and Au^{198} the polarization is $(-v/c)$. (auth)

4533
DECAY OF Ce^{144} AND Pr^{144}. R. L. Hickok, W. A. McKinley, and S. C. Fultz (Rensselaer Polytechnic Inst., Troy, N. Y.). Phys. Rev. 109, 113-16(1958) Jan. 1.

The beta and gamma spectra from the decay of Ce^{144} and Pr^{144} have been investigated by means of a magnetic-lens beta spectrometer and single-channel scintillation spectrometers. Three partial beta spectra with end-point energies and relative intensities of 184 kev (30%), 245 kev (5%), and 320 kev (65%) were observed for Ce^{144}. Gamma rays and internal conversion lines corresponding to 54, 80, and 134-kev transitions were also detected. Internal conversion coefficients indicate an M1 multipolarity for the 80- and 134-kev transitions. Pr^{144} yields three partial beta spectra with end-point energies and relative intensities of 0.90 Mev (2%), 2.45 Mev (3%), and 3.15 Mev (95%). Corresponding gamma rays were also detected. Beta-gamma and gamma-gamma coincidence measurements substantiate the proposed decay scheme. (auth)

4534
MEASUREMENT OF BETA-RAY POLARIZATION OF Au^{198} BY DOUBLE COULOMB SCATTERING. H. J. Lipkin, S. Cuperman, T. Rothem, and A. de-Shalit (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 109, 223-4 (1958) Jan.

4535
NEUTRON EMISSION BY EXCITED RaD NUCLEI. A. V. Kogan and L. I. Rusinov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 365-71(1957) Oct.

Neutron emission from an active deposit of radium emanation on pure heavy metals was investigated. It is shown that the observed neutron activity is related to disintegration of the RaC″(Tl^{210}) isotope. The neutrons are apparently emitted by excited RaD(Pb^{210}) nuclei produced as a result of β disintegration of RaC″. Control experiments have been carried out which permit one to estimate the contribution of other possible processes to the neutron radiation from the shortlived active radon deposit. (auth)

4536
INTERNAL CONVERSION COEFFICIENT OF THE 53 kev GAMMA-RADIATION ON THE L SHELL OF Th^{230}. A. A. Vorob'ev, V. A. Korolev, A. P. Komar, and D. M. Seliverston (Academy of Sciences, USSR). Soviet Phys. JETP 5, 516-17(1957) Oct.

Rare Earths and Rare-earth Compounds

4537
MAGNETIC PROPERTIES OF RARE EARTH FERRITES WITH GARNET STRUCTURE. M. R. Pauthenet. J. phys. radium 18, 70S-1S(1957) Nov. (In French)

4538
NORMAL AND SUPERCONDUCTING HEAT CAPACITIES OF LANTHANUM. A. Berman, M. W. Zemansky, and H. A. Boorse (Columbia Univ., New York). Phys. Rev. 109, 70-6(1958) Jan. 1.

The heat capacities of three samples of lanthanum have been measured in the temperature range 1.6 to 6.5°K. A four-constant formula was found which represented to high precision the resistance-temperature relation of the carbon composition resistance thermometer from 1.6 to 7.2°K. Two superconducting transitions were found in each sample: one at 4.8°K and the other at 5.9°K. These are associated respectively with the hexagonal close-packed and face-centered cubic modifications of the metal. Below 2.5°K, a magnetic field of 10,000 gauss was found insufficient to quench completely the superconducting phase. The values of the normal heat capacity constants for the purest sample, averaged over the two crystal structures present, were determined by a thermodynamic analysis of the data to be $\gamma = (24.1 \pm 0.6) \times 10^{-4}$ cal/mole $(°K)^2$, $\Theta = 142 \pm 3°K$. The data are further analyzed for evidence of a law of corresponding states among superconductors. (auth)

4539
STUDIES OF RARE EARTH ALPHA EMITTERS. Kenneth S. Toth and John O. Rasmussen (Univ. of Calif., Berkeley). Phys. Rev. 109, 121-5(1958) Jan. 1.

A series of bombardments using alpha particles from the Berkeley 60-inch cyclotron on rare earth oxides has resulted in the discovery and mass assignment of two new alpha-emitting isotopes, Dy^{153} (5 hr) and Dy^{154} (13 hr). Mass assignments have been made for two other alpha emitters, Dy^{152} (2.3 hr) and Tb^{151} (19 hr). A new 10-hr electron-capture isotope has been identified as Dy^{155}. Evidence is also presented for the discovery of another isotope, Dy^{149} (8 min), which was produced by a N^{14} ion bombardment on praseodymium. (auth)

Shielding

Refer also to abstract 4635.

4540 KAPL-M-SSD-43(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G PRIMARY SHIELD WATER SYSTEM; DESIGN DESCRIPTION. G. V. Krauss. Sept. 27, 1957. 18p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The function of the Shield Water System is to provide shielding to protect personnel from excessive neutron radiation. Shielding is accomplished by enclosing the pressure vessel sides and bottom in an annular shaped tank which is maintained full of water at atmospheric pressure. The Shield Water System consists of the neutron shield tank which surrounds the pressure vessel, the shield water expansion tank, interconnecting piping and valves, instruments and an alarm system. The expansion tank insures that the shield tank will be full of water at all times by maintaining a supply of water in reserve and by providing adequate facilities for adding additional water while the reactor plant is in operation. The expansion tank also provides for volume changes due to thermal expansion of the shield water. The interconnecting piping and valves are used for filling, adding rust inhibitor, and draining. In the event of low level in the expansion tank, an alarm located on the RPCB and an alarm light located in the vicinity of the expansion tank will be energized warning the operator of this condition. (auth)

4541
RADIATION SHIELDING IN NUCLEAR REACTORS. H. Glubrecht. Atomkern Energie 2, 475-81(1957) Nov.-Dec. (In German)

Spectroscopy

4542
NEW LINES IN THE SPECTRA OF ZIRCONIUM. William E. W. Howe (Georgetown Univ., Washington). J. Opt. Soc. Amer. 48, 28-30(1958) Jan.

Two-hundred and twenty-four new atomic zirconium lines are found in the region between 6100 and 6500 A. Fifty-four are attributed to transitions between previously determined terms of neutral zirconium, Zr I. One is attributed to known terms of singly ionized zirconium, Zr II. (auth)

4543
THE SPECTRA OF THE M AND L AUGER ELECTRONS OF Bi^{212} AND Tl^{208}. K. Risch. Z. Physik 150, 87-98 (1958). (In German)

Theoretical Physics

4544
RADIATION OF CHARGED PARTICLES IN FLIGHT PAST IDEALLY CONDUCTING BODIES. Yu. N. Dnestrovskii and D. P. Kostomarov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 116, 377-80(1957) Sept. 11. (In Russian)

The general problem of radiation emission by charged particles in flight past ideally conducting bodies was investigated in nonrelativistic approximation. Without considering the retardation factor, the charge motion was integrated and magnitudes of the charges and currents inducted on the screen (electrical field is considered as electrostatic field depending on the time and parameter) was found. The emitting currents were determined using the solution of the above problems. (R.V.J.)

4545
A COMMENT ON LANDAU'S METHOD OF INTEGRATION IN QUANTUM ELECTRODYNAMICS. Susumu Kamefuchi (Univ. of Copenhagen). Kgl. Danske Videnskab. Selskab. Mat. fys. Medd. 31, No. 6, 1-12(1957).

It is shown that the integration method of Landau et al. is inconsistent even in the energy region below the cut-off. This inconsistency is present also when no ghost states appear. This result implies that Landau's method is not self-consistent even for a finite cut-off. (auth)

4546
ON THE QUANTIZATION OF TENSOR FIELDS WITH ZERO MASS. C. G. Bollini. Nuovo cimento (10) 6, 1034-9 (1957) Nov.

A general formulation of quantum field theory for massless tensor fields, compatible with the supplementary conditions, is given. The free field (or the interacting field in the interaction representation) is expressed in terms of its components "along" the transversal polarization tensors defined in the text. These components are taken as canonical co-ordinates, on which the canonical commutation relations are imposed. The corresponding commutation relations of the field components are given. (auth)

4547
PARAMETRIC REPRESENTATIONS OF GENERAL GREEN'S FUNCTIONS. Y. Nambu (Univ. of Chicago, Ill.). Nuovo cimento (10) 6, 1064-83(1957) Nov.

Parametric representations for the Green's function of field theory are derived in perturbation theory. These representations are valid for each term in the perturbation series that corresponds to a Feynman diagram, and reflect its analytic property and threshold characteristics. As an example, the three-body (vertex) function is shown to satisfy a dispersion relation when two of the three momenta are fixed, with the correct location of the singularities expected from the thresholds of the competing real processes. (auth)

4548
FIELD OPERATORS AND RETARDED FUNCTIONS. V. Glaser, H. Lehmann, and W. Zimmermann. Nuovo cimento (10) 6, 1122-8(1957) Nov.

A formula for the expansion of field operators with respect to products of ingoing fields is derived. The coefficients in this expansion are the retarded functions introduced earlier. They fulfil a system of equations which turns out to be not only a necessary but also sufficient condition for such functions to yield a local field operator. (auth)

4549
RENORMALIZATION OF A PARITY NON-CONSERVING THEORY. B. d'Espagnat and J. Prentki (CERN, Genève). Nuovo cimento (10) 6, 1129-34(1957) Nov. (In French)

The extension of the renormalization procedure to a parity non conserving theory is investigated. For the sake of definiteness a parity non conserving interaction term is assumed, which means that a parity non conserving (but CP invariant) nucleon-hyperon-K interaction is postulated: CP invariance is here introduced so that the α/β ratio of terms with opposite parities could eventually be appreciable without violating known experimental data (absence of electric dipole moment for elementary particles). It is shown that the theory represented is indeed renormalizable. In the proposed renormalization procedure a real physical nucleon still has a definite parity with respect to the bare nucleon. Effects of parity non conservation are then entirely contained in the renormalized vertex operators $\Gamma_r^{\pm}$ as well as in the renormalized baryon propagation function $S_r(p)$, which, however, tends to the same limiting form as the usual $S_r(p)$ of a parity conserving theory in the limit where p tends towards the four momentum of a real particle. It is considered that such a renormalization scheme is necessary if quantitative estimation of the maximum admissible α/β ratio compatible with experimental data is desired. (auth)

4550
HILBERT SPACES IN QUANTUM FIELD THEORIES. S. Albertoni and F. Duimio. Nuovo cimento (10) 6, 1193-1205(1957) Nov.

One examines the structure of the Hilbert space spanned by the states of a quantized field. A hypothesis is made concerning the possibility of a physical interpretation of various subspaces of it, and connections with some pathological results derived by several authors, are indicated. (auth)

4551
THEORY OF THE FERMI INTERACTION. R. P. Feynman and M. Gell-Mann (California Inst. of Tech., Pasadena). Phys. Rev. 109, 193-8(1958) Jan. 1.

The representation of Fermi particles by two-component Pauli spinors satisfying a second order differential equation and the suggestion that in β decay these spinors act without gradient couplings leads to an essentially unique weak four-fermion coupling. It is equivalent to equal amounts of vector and axial vector coupling with two-component neutrinos and conservation of leptons. (The relative sign is not determined theoretically.) It is taken to be "universal"; the lifetime of the μ agrees to within the experimental errors of 2%. The vector part of the coupling is, by analogy with electric charge, assumed to be not renormalized by virtual mesons. This requires, for example, that pions are also "charged" in the sense that there is a direct interaction in which, say, a π^0 goes to π^- and an

electron goes to a neutrino. The weak decays of strange particles will result qualitatively if the universality is extended to include a coupling involving a Λ or Σ fermion. Parity is then not conserved even for those decays like $K \rightarrow 2\pi$ or 3π which involve no neutrinos. The theory is at variance with the measured angular correlation of electron and neutrino in He^6, and with the fact that fewer than 10^{-4} pion decay into electron and neutrino. (auth)

4552

TIME REVERSAL, CHARGE CONJUGATION, MAGNETIC POLE CONJUGATION, AND PARITY. N. F. Ramsey (Harvard Univ., Cambridge, Mass.). Phys. Rev. 109, 225-6(1958) Jan. 1.

4553

ELECTRON SCATTERING AND MODEL INDEPENDENCE. D. G. Ravenhall and D. R. Yennie (Stanford Univ.). Proc. Phys. Soc. (London) A70, 857-62(1957) Dec.

A critical examination is made of the hypothesis of model independence in high-energy electron scattering from nuclei. Results are presented which indicate that, contrary to this hypothesis, any differences in nuclear charge distributions result in differences in the electron angular distributions which become more and more pronounced as the energy is increased. The fallacies of the arguments leading to this hypothesis are noted, and comments are made on the scattering process. (auth)

4554

THE DESCRIPTION OF COLLECTIVE MOTIONS IN TERMS OF MANY-BODY PERTURBATION THEORY. II. THE CORRELATION ENERGY OF A FREE-ELECTRON GAS. J. Hubbard (Atomic Energy Research Establishment, Harwell, Didcot, Berks, Eng.). Proc. Royal Soc. (London), A243, 336-52(1958) Jan. 14.

The theory developed in a previous paper is applied to calculate the correlation energy of a free-electron gas. The theory involves no cut-off and gives a uniform description of collective motion effects in the long-range limit and of particle motion effects in the short-range limit. It is shown that in the lowest order the theory agrees with Bohm & Pines's plasma oscillation theory in the long-range limit, but is inadequate in the short-range limit. The theory is approximately evaluated to the next order, which is correct in the short-range limit, and is applied to calculate the correlation energy at several gas densities; the results are in good agreement with those of Bohm & Pines. (auth)

4555

CHARGE INVARIANCE IN NUCLEAR REACTIONS. A. I. Baz. Soviet Phys. JETP 5, 403-12(1957) Oct.

It is shown that there exists a relation between the cross sections of the reactions $He^3(pp)He^3$, $He^3(nn)He^3$, $He^3(np)T$; $T(pn)He^3$; $T(pp)T$. This relation is based on the hypothesis of charge invariance of nuclear forces; because of it the number of independent parameters (phases) necessary for a complete description of these reactions can be reduced. The cross sections of these reactions are all expressed by the same parameters $\delta(T)$ and $\epsilon(T)$ [the phases and mixture parameters in a state with isotopic spin T] and thus it is possible to carry out a phase analysis of all these reactions simultaneously. The method applied is a general one and is applicable, with only slight changes, to all reactions involving light nuclei. (auth)

4556

SOME RELATIVISTIC PROPERTIES OF THE BEHAVIOR OF SPIN-½ PARTICLES. P. E. Kunin and I. M. Taksar (Academy of Sciences, Latvian SSR). Soviet Phys. JETP 5, 426-8(1957) Oct.

It is shown that in the case of a scalar field the Klein paradox does not arise for spin-½ particles tunneling through a potential barrier. The particle does not fall toward the center of a centrally symmetric field even when a high-order pole exists in the center. This result also holds in classical relativistic theory. (auth)

4557

CONTRIBUTION TO THE THEORY OF COLLECTIVE MOTION OF PARTICLES IN QUANTUM MECHANICAL SYSTEMS. V. M. Eleonskii and P. S. Zyrianov (Ural Polytechnic Inst.). Soviet Phys. JETP 5, 432-5(1957) Oct.

A method for separating the collective motions in a system of interacting particles is presented. The connection between this method and others is established. An attempt is made to give a basis to the generalized heavy nucleus model. (auth)

4558

CONTRIBUTION TO FIELD THEORY INVOLVING A CUT-OFF FACTOR. D. A. Kirzhnits (Academy of Sciences, USSR). Soviet Phys. JETP 5, 445-51(1957) Oct.

A study is made of the question of the uniqueness of quantum field theory involving a cut-off factor, and it is found that even finite (renormalized) expressions depend on the form of the cut-off factor. Examples are given in which the renormalized Green's function of a boson has no pole for finite momenta, but the critical momentum in the charge renormalization can be made arbitrarily large. In this connection difficulties with the vanishing of the charge and the existence of a pole in the Green's function are considered, and also the question of the domain of applicability of meson theory. (auth)

4559

PRODUCTION OF PROTON-ANTIPROTON PAIRS BY HIGH ENERGY γ-QUANTA. Iu. A. Vdovin (Moscow Engineering-Physics Inst.). Soviet Phys. JETP 5, 452-5(1957) Oct.

The production of proton–antiproton pairs by high energy γ quanta on nuclei is investigated by a semi-phenomenological method. A knowledge of the asymptotic expression of the function of each nucleon is sufficient for the computation of the effective cross section. On the assumption that the nucleus is "black" with respect to the nucleons, the asymptotic expression has been found as a superposition of a plane and diffracted waves. The calculations are extended to the case of an arbitrary interaction law between the nucleons and nucleus. The differential cross section is then expressed in terms of the amplitude of elastic scattering of nucleons on the nucleus. (auth)

4560

ON THE POSSIBILITY OF FORMULATING A MESON THEORY WITH SEVERAL FIELDS. A. D. Galanin. Soviet Phys. JETP 5, 460-4(1957) Oct.

The following cases of interaction of several fields are considered: (1) N fermion and n boson fields with the same coupling constant, (2) two fermion and two boson fields, interacting with different constants, (3) fermion and boson fields with different isotopic properties. In all cases considered the physical charge tends to zero as the extended interaction approaches a point one. (auth)

4561

CONCERNING SOME POSSIBILITIES OF FORMULATION OF A RELATIVISTICALLY INVARIANT THEORY OF EXTENDED PARTICLES. V. S. Barashenkov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 470-2(1957) Oct.

Various problems pertaining to the theory of extended particles are examined in the case of the classical (nonquantum) theory of interacting dynamically indeformable extended particles. Although the structure of the theory is not of the Hamiltonian type, a formulation in Lagrangian variables x_k; $\dot{x}_k$; A_μ; $\dot{A}_\mu$, as well as Hamiltonian variables

x_k; p_k; A_μ; π_μ can be given. The possibility of a many time formalism is examined, and the latter is found to be non-unique. However, in none of the cases was a transition to a single-time theory found and the system of equations of motion was found to be inconsistent. (auth)

4562

THE APPLICATION OF THE MICROCANONICAL DISTRIBUTION TO THE STATISTICAL THEORY OF MULTIPLE PRODUCTION OF PARTICLES. V. B. Magalinskii and Ia. P. Terletskii (Academy of Sciences, USSR). Soviet Phys. JETP 5, 483-8(1957) Oct.

The general statistical method of the microcanonical distribution is applied to the problem of the computation of statistical weights for the reactions of production of π mesons in collisions of nucleons with nucleons. A general formula is derived for computation of the statistical weight of a state with an arbitrary set of particles, considering not only the laws of conservation of energy and momentum, but also the different type of statistics for fermions and bosons. In allowing all particles to obey Boltzmann statistics, this general formula reduces to the formula proposed by other authors. In particular, corrections are found which are due to consideration of the type of statistics for all possible collision processes of nucleons with nucleons, in which not more than three mesons are created. (auth)

4563

THE CHARACTER OF NUCLEONIC FORCES. A. Z. Dolginov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 506-8(1957) Oct.

4564

POLARIZATION IN REVERSE REACTIONS. A. I. Baz'. Soviet Phys. JETP 5, 521-3(1957) Oct.

A relation which holds between the polarization of final particles in forward and reverse reactions is demonstrated. (L.T.W.)

4565

POLARIZATION OF CHERENKOV RADIATION. A. A. Sokolov and Iu. M. Loskutov (Moscow State Univ.). Soviet Phys. JETP 5, 523-5(1957) Oct.

4566

THE QUANTUM MECHANICS OF FORCE-FREE PARTICLES. M. Born and W. Ludwig. Z. Physik 150, 106-17 (1958). (In German)

Uranium and Uranium Compounds

4567 APDA-118

Atomic Power Development Associates, Inc., Detroit.
EQUATION OF STATE AND HEAT CONTENT OF URANIUM. Robert H. Brout. Feb. 20, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

This report presents some calculations made on the equation of state of U at high temperature and pressure. Included are estimates of internal energy, entropy, and the adiabatic work available from varying high pressure states of several reduced pressures. Experimental data for U exist only at temperatures slightly above the melting point (1630 to 1970°K), including particularly the experiments which extend up to 1970°K. The temperatures of interest are 10 and more times higher. For such temperatures, one must rely upon estimates based on "universal" relations among various thermodynamic variables. These relations employ the principle of corresponding states which says that all substances are equivalent at a given specification of corresponding or reduced variables. It is customary to reduce the variables by dividing them by their values at the critical point, this being the most obvious corresponding point. The first task is the evaluation of the critical constants. (auth)

4568 IGR-TN/C-710

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
MELTING AND CASTING OF URANIUM: A REVIEW OF PROGRESS TO JUNE 23, 1957. (ULTRASONIC GRAIN REFINEMENT). N. D. Baines and E. Manson. Dec. 1957. 7p.

Ultrasonic vibrations applied to molten U during solidification reduce the maximum grain size by a factor of four in some cases, but average grain size is not reduced. The absence of any grain refinement, as judged from the average grain size, indicates that this method is not successful in U. (J.E.D.)

4569 K-1370

Oak Ridge Gaseous Diffusion Plant, Tenn.
EXTENSION OF THE SAFE GEOMETRIC PARAMETERS TO SLIGHTLY ENRICHED URANIUM. C. E. Newlon. Jan. 23, 1958. 9p. Contract W-7405-eng-26. $0.50(OTS).

Use is made of a method of buckling comparisons to extend the safe geometric criticality parameters of the infinite cylinder, infinite slab, and the sphere, to U of enrichments between 0.72 and 5% U^{235} assays. The new criteria complete the determination of the assay variation of these safe parameters and permit their tabulation for U of all enrichments. Comparison with the available experimental data which include results of the Hanford Physical Constants Testing Reactor, together with previous ORGDP studies based on the Water Boiler Theory, indicates that the new criteria may be safely applied to the U systems normally encountered in gaseous diffusion plant operations. (auth)

4570 LA-2071

Los Alamos Scientific Lab., N. Mex.
ROLLING OF URANIUM. J. D. Duncan, G. S. Hanks, J. M. Taub, D. T. Doll, T. L. Crisler, D. S. Fisher, and V. Vigil. Feb. 1957. 217p. Contract W-7405-eng-36. $33.30(ph OTS); $9.60(mf OTS).

Information concerned with the fabrication of U sheet is presented. Starting with cast U plate, the metal was hot rolled at 600 to 625°C to some intermediate thickness. The semi-finished sheet was rolled further to final thickness either warm (300 to 340°C) or cold. The characteristics of the finished sheet in respect to crystal orientation or "directionality" were to a considerable degree dependent upon the rolling schedules. A number of schedules using unidirectional rolling or various amounts of cross rolling with or without intermediate annealing were examined. From this experience three basic rolling schedules were developed. Results have indicated that these schedules will produce sheet satisfactory for a variety of forming processes. The mechanical properties and orientation as imparted to the sheet by the several rolling schedules were examined. In some measure, these properties helped to guide the changes made in the rolling schedules. The grain size of the sheet was affected by time and temperature of annealing, and the percent reduction prior to annealing. Mechanical properties were appreciably altered by the method of annealing. Salt annealing tended to embrittle the metal while vacuum annealing improved the ductibility. (auth)

4571

MAGNETIC PROPERTIES OF UMn_2. S. T. Lin and A. R. Kaufmann (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 1171-4(1957) Dec. 1.

The magnetic properties of UMn_2 were investigated for the temperature range from 360 down to 4.2°K. Below room temperature the magnetization curves are slightly bent

toward the field axis and below 230°K the sample showed a small remanence. The susceptibility against temperature curve shows a λ-type anomaly at 260°K and a steep increase at about 4°K. The hysteresis loops are not symmetrical with respect to the origin and the degree of asymmetry depends upon either the temperature or whether the sample was cooled in magnetic field or without field. From some evidence, UMn_2 is classified as an antiferromagnetic material with a small parasitic ferromagnetism which may arise from uncompensated sublattice moments or uncompensated domain wall magnetization. (auth)

4572

FISSION YIELDS OF NATURAL URANIUM WITH DEUTERONS OF 5, 10, AND 13.6 Mev: DEUTERON CAPTURE AND COMPETITION WITH STRIPPING. T. T. Sugihara, P. J. Drevinsky, and E. J. Troianello (Clark Univ., Worcester, Mass.) and J. M. Alexander (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 1264-73(1957) Dec. 1.

Radiochemical determinations of yields in the fission of natural uranium with 5-, 10-, and 13.6-Mev deuterons have been made for 35 mass chains from mass numbers 72 to 159. The total fission cross sections at the three energies were found to be 3.5, 86, and 430 mb, respectively, by integration of the mass-distribution curve. These cross sections include contributions from the fast-neutron background, which is negligible at the two higher energies but which constitutes nearly all of the observed fission at 5 Mev. Although in gross features the yield-mass curves resemble those for other fissile nuclei, some important differences are apparent. The highly asymmetric yields change nearly as rapidly with energy as those of the valley; the deuteron yield curves are the broadest that have been observed at these energies. From analysis of yield measurements for nearly complementary masses it has been found that fewer neutrons are emitted in modes leading to highly asymmetric products as compared to the most probable modes. The average number of neutrons per fission is found to be 3.5, 5.0, and 5.0 with deuterons of 5, 10, and 13.6 Mev. The measured valley-to-peak yield ratios at 10 and 13.6 Mev are smaller than would be expected from deuteron capture. It is concluded that at these energies a small but significant contribution is made by fission following a (d,p) or (d,n) stripping reaction. From known (d,p), (d,n), and fission cross sections, the proton-energy spectrum in (d,p) stripping on heavy nuclei, and estimated branching ratios for modes of decay of a heavy excited nucleus, it is calculated that the fraction of fission events following deuteron capture is 0.8 ± 0.2 with 13.6-Mev deuterons and 0.75 ± 0.25 with 20-Mev deuterons, the remainder following a (d,p) or (d,n) stripping reaction. (auth)

4573

CAPTURE-TO-FISSION RATIOS FOR FAST NEUTRONS IN U^{235}. B. C. Diven, J. Terrell, and A. Hemmendinger (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 144-50 (1958) Jan. 1.

The ratio $\alpha = \sigma_c/\sigma_f$, where σ_c is the neutron capture cross section and σ_f the neutron-induced fission cross section, has been measured for U^{235} as a function of neutron energy. A pulsed and collimated neutron beam is passed through a U^{235} sample at the center of a large liquid scintillator. Captures and fissions are detected by means of their prompt gamma rays; elastic and inelastic scattering events are ignored because of smaller pulse heights. Fissions are distinguished from captures by means of delayed pulses from the capture of thermalized fission neutrons. It is found that in the neutron energy range E_n = 0.175 to 1.0 Mev the value of α is given approximately by $\alpha = 0.190$ to $0.116E_n$. The accuracy of the determination of α is 10 to 15% in terms of the standard deviation and individual points. (auth)

4574

SELF-CONSISTENT FIELD WITHOUT EXCHANGE FOR U^{6+}. E. Cicely Ridley (Atomic Energy Research Establishment, Harwell, Didcot, Berks, Eng.). Proc. Royal Soc. (London), A243, 422-34(1958) Jan. 14.

The results of a self-consistent field calculation without exchange for U^{6+} are presented. Initial estimates of the field were obtained by a process of extrapolation based on a comparison of isoelectronic series having the configuration $(ns)^2(np)^6$ in the outer shell. (auth)

PATENTS

Chemistry

4575

USE OF EMULSIFIED OILS FOR THE CONCENTRATION OF URANIUM ORES BY FROTH FLOTATION. P. K. Hosking (to Minister of Mines for the State of South Australia). British Patent 780,021. Nuclear Eng. 3, 42 (1958) Jan.

The recovery of uranium minerals by gravity methods has proved very inefficient for low-grade ores. By treating the ore to a state of fineness wherein the mineral particles are freed from the gangue material. Then, first forming an aqueous pulp (having added the required reagents before, during or after the subdividing process) and subjecting the mixture to agitation and aeration in a froth flotation cell, a froth rich in uranium minerals is obtained. The reagents comprise an insoluble and unsaponifiable hydrocarbon oil (e.g. fuel oil) emulsified with an anionic water soluble emulsifying agent (e.g. sulphonated castor oil), and stabilized with an oil soluble stabilizing agent (cresylic acid).

4576

EXTRACTION OR RECOVERY OF URANIUM AND OTHER METALS. L. Tavener and D. Millin. British Patent 780,471. Nuclear Eng. 3, 42(1958) Jan.

The uranium-bearing ore or concentrate is subjected to chlorination, with elementary chlorine in a liquid aqueous medium, to bring the uranium into soluble form. The solution is then treated to precipitate an insoluble uranium compound. The (roasted) material may, e.g., be leached with an acidified hypochlorite solution, which also may yield gold and other metals. The gold may be deposited in powder form by electrolysis. The uranium may be recovered by normal precipitation.

4577

PROCESS FOR REMOVING HAFNIUM FROM ZIRCONIUM-CONTAINING MATERIAL. I. E. Newnham (to Commonwealth Scientific and Industrial Research Organization). British Patent 780,477. Nuclear Eng. 3, 42(1958) Jan.

The zirconium compounds and the associated hafnium compounds are converted into tetrahalides. The zirconium tetrahalide is reduced to one or more lower halides or even to metallic zirconium, while the hafnium tetrahalide remains unchanged. This and any unreduced zirconium tetrahalide is then separated from the zirconium reduction product.

4578

PRODUCTION OF URANIUM METAL. A. E. Williams (to U. K. Atomic Energy Authority). British Patent 780,974. Nuclear Eng. 3, 42(1958) Jan.

Uranium tetrafluoride and magnesium metal are compacted, e.g. compressed into pellets, so as to raise ap-

preciably the bulk density of the charge. The density should be at least 3 g/cc. If the two reactants are rapidly heated to the temperature of initiation of the reaction, a consistent yield of uranium metal may be obtained. Hitherto large-scale production (batches of 100 kg) using magnesium instead of calcium for the reduction of the tetrafluoride has not been satisfactory because of serious variations in respect of efficiency from batch to batch.

4579

COMBINED MIXING AND SETTLING APPARATUS FOR LIQUIDS. (To U. K. Atomic Energy Authority (U.S.A.)). British Patent 781,224. Nuclear Eng. 3, 42(1958) Jan.

A multi-stage arrangement of mixer-settlers is described for handling two liquids of which one is of a relatively high density, such as an aqueous solution of a solvent-extractable metal nitrate (cerium nitrate) containing a salting-out agent (nitric acid); while the other is of low density, such as a water-immiscible organic solvent (tributyl phosphate). The two liquids are to be repeatedly mixed and separated from one another, and the organic solvent is to extract metal values from the aqueous solution. The structural arrangement permits interface control dependent upon the difference in height of overflow and top of weir tube. By adjustment of the weir tube the control of the interface between liquids, even of small density difference, is easily accomplished. This is important, as the densities of the liquids vary from one settling chamber to the other; depending on how completely they are separated, and on the extent to which the metal values have been transferred from the aqueous solution to the organic solvent in these chambers.

4580

PRODUCTION OF TRIFLUOROACETIC ACID. W. N. Haworth and M. Stacey (to U. S. Atomic Energy Commission). U. S. Patent 2,476,490. July 19, 1949.

A method is given for the production of improved yields of trifluoroacetic acid. The compound is prepared by oxidizing m-aminobenzotrifluoride with an alkali metal or alkaline earth metal permanganate at a temperature in the range of 80°C to 100°C while dissolved in a mixture of water with glacial acetic acid and/or trifluoroacetic acid. Preferably a mixture of water and trifluoroacetic acid is used as the solvent.

4581

PRODUCTION OF TRIFLUOROACETIC ACID COMPOUNDS. W. N. Haworth and M. Stacey (to U. S. Atomic Energy Commission). U. S. Patent 2,480,467. Aug. 30, 1949.

A process is described for the preparation of trifluoroacetic acid. Acetone vapor diluted with nitrogen and fluorine also diluted with nitrogen are fed separately at a temperature of about 210°C into a reaction vessel containing a catalyst mass selected from the group consisting of silver and gold. The temperature in the reaction vessel is maintained in the range of 200° to 250°C. The reaction product, trifluoroacetyl fluoride, is absorbed in aqueous alkali solution. Trifluoroacetic acid is recovered from the solution by acidification with an acid such as sulfuric followed by steam distillation.

4582

PRODUCTION OF URANIUM AND THORIUM COMPOUNDS. T. V. Arden, F. H. Burstall, R. P. Linstead, and R. A. Wells (to U. S. Atomic Energy Commission). U. S. Patent 2,728,633. Dec. 27, 1955.

Compounds of Th and U are extracted with an organic solvent in the presence of an adsorbent substance which has greater retentivity for impurities present than for the uranium and/or thorium. The preferred adsorbent material is noted as being cellulose. The uranium and thorium-containing substances treated are preferably in the form of dissolved nitrates, and the preferred organic solvent is diethyl ether.

4583

FLUID CONTACTOR APPARATUS. R. Spence and Robert J. W. Streeton (to U. S. Atomic Energy Commission). U. S. Patent 2,742,348. Apr. 17, 1956.

The fluid contactor apparatus comprises a cylindrical column mounted co-axially and adapted to rotate within a cylindrical vessel, for the purpose of extracting a solute from an aqueous solution by means of an organic solvent. The column is particularly designed to control the vortex pattern so as to reduce the height of the vortices while, at the same time, the width of the annular radius in the radial direction between the vessel and column is less than half the radius of the column. A plurality of thin annular fins are spaced apart along the rotor approximately twice the radial dimension of the column such that two contra-rotating substantially circular vortices are contained within each pair of fins as the column is rotated.

4584

SEPARATING HAFNIUM FROM ZIRCONIUM. B. A. J. Lister, J. F. Duncan, and J. M. Hutcheon (to U. S. Atomic Energy Commission). U. S. Patent 2,759,792. Aug. 21, 1956.

Substantially complete separation of zirconium from hafnium may be obtained by elution of ion exchange material, on which compounds of the elements are adsorbed, with an approximately normal solution of sulfuric acid. Preferably the acid concentration is between 0.8 N and 1.2 N, and should not exceed 1.5 N. Increasing the concentration of sulfate ion in the eluting solution by addition of a soluble sulfate, such as sodium sulfate, has been found to be advantageous. The preferred ion exchange materials are sulfonated polystyrene resins such as "Dowex 50," and are preferably arranged in a column through which the solutions are passed.

4585

SEPARATING HAFNIUM FROM ZIRCONIUM. B. A. J. Lister and J. F. Duncan (to U. S. Atomic Energy Commission). U. S. Patent 2,759,793. Aug. 21, 1956.

A dilute aqueous solution of zirconyl chloride which is 1N to 2N in HCl is passed through a column of a cation exchange resin in acid form thereby absorbing both zirconium and associated hafnium impurity in the resin. The cation exchange material with the absorbate is then eluted with aqueous sulfuric acid of a 0.8N to 1.2N strength. The first portion of the eluate contains the zirconium substantially free of hafnium.

4586

GOLD PLATING PROCESS. R. Seegmiller (to U. S. Atomic Energy Commission). U. S. Patent 2,801,960. Aug. 6, 1957.

An improved bath is reported for plating gold on other metals. The composition of the plating bath is as follows: Gold cyanide from about 15 to about 50 grams, potassium cyanide from about 70 to about 125 grams, and sulfonated castor oil from about 0.1 to about 10 cc. The gold plate produced from this bath is smooth, semi-hard, and nonporous.

4587

ARRANGEMENT FOR REPLACING FILTERS. R. A. Blomgren and N. J. C. Bohlin (to U. S. Atomic Energy Commission). U. S. Patent 2,804,165. Aug. 27, 1957

An improved filtered air exhaust system which may be continually operated during the replacement of the filters without the escape of unfiltered air is described. This is accomplished by hermetically sealing the box like filter containers in a rectangular tunnel with neoprene covered

sponge rubber sealing rings coated with a silicone impregnated pneumatic grease. The tunnel through which the filters are pushed is normal to the exhaust air duct. A number of unused filters are in line behind the filters in use, and are moved by a hydraulic ram so that a fresh filter is positioned in the air duct. The used filter is pushed into a waiting receptacle and is suitably disposed. This device permits a rapid and safe replacement of a radiation contaminated filter without interruption to the normal flow of exhaust air.

4588

PRODUCTION OF URANIUM HEXAFLUORIDE. R. D. Fowler (to U.S. Atomic Energy Commission). U. S. Patent 2,804,369. Aug. 27, 1957.

A process for the production of uranium hexafluoride from the oxides of uranium is reported. In accordance with the method, the higher oxides of uranium may be reduced to uranium dioxide (UO_2), the latter converted into uranium tetrafluoride by reaction with hydrogen fluoride, and the UF_4 converted to UF_6 by reaction with a fluorinating agent, such as CoF_3. The UO_3 or U_3O_8 is placed in a reaction chamber in a copper boat or tray enclosed in a copper oven, and heated to 500 to 650°C while hydrogen gas is passed through the oven. After nitrogen gas is used to sweep out the hydrogen and the water vapor formed, and while continuing to maintain the temperature between 400°C and 600°C, anhydrous hydrogen fluoride is passed through. After completion of the conversion of UO_2 to UF_4 the temperature of the reaction chamber is lowered to about 400°C or less, the UF_4 is mixed with the requisite quantity of CoF_3, and after evacuating the chamber, the mixture is heated to 300 to 400°C, and the resulting UF_6 is led off and delivered to a condenser.

4589

URANIUM OXIDE-CONTAINING FUEL ELEMENT COMPOSITION AND METHOD OF MAKING SAME. J. H. Handwerk, R. A. Noland, and D. E. Walker (to U. S. Atomic Energy Commission). U. S. Patent 2,805,473. Sept. 10, 1957.

In the past, bodies formed of a mixture of uranium dioxide and aluminum powder have been used in fuel elements; however, these mixtures were found not to be suitable when exposed to temperatures of about 600°C, because at such high temperatures the fuel elements were distorted. If uranosic oxide, U_3O_8, is substituted for UO_2, the mechanical properties are not impaired when these materials are used at about 600°C and no distortion takes place. The uranosic oxide and aluminum, both in powder form, are first mixed, and after a homogeneous mixture has been obtained, are shaped into fuel elements by extrusion at elevated temperature. Magnesium powder may be used in place of the aluminum.

4590

CONVERSION OF PLUTONIUM TRIFLUORIDE TO PLUTONIUM TETRAFLUORIDE. S. Fried and N. R. Davidson (to U. S. Atomic Energy Commission). U. S. Patent 2,805,916. Sept. 10, 1957.

A large proportion of the trifluoride of plutonium can be converted, in the absence of hydrogen fluoride, to the tetrafluoride of plutonium. This is done by heating plutonium trifluoride with oxygen at temperatures between 250 and 900°C. The trifluoride of plutonium reacts with oxygen to form plutonium tetrafluoride and plutonium oxide, in a ratio of about 3 to 1. In the presence of moisture, plutonium tetrafluoride tends to hydrolyze at elevated temperatures and therefore it is desirable to have the process take place under anhydrous conditions.

4591

ELECTRODEPOSITION OF PLUTONIUM. F. J. Wolter (to U. S. Atomic Energy Commission). U. S. Patent 2,805,985. Sept. 10, 1957.

A process of electrolytically recovering plutonium from dilute aqueous solutions containing plutonium ions comprises electrolyzing the solution at a current density of about 0.44 ampere per square centimeter in the presence of an acetate-sulfate buffer while maintaining the pH of the solution at substantially 5 and using a stirred mercury cathode.

4592

URANIUM RECOVERY AND PURIFICATION PROCESS AND PRODUCTION OF HIGH PURITY URANIUM TETRAFLUORIDE. R. H. Bailes, R. S. Long, and R. R. Grinstead (to U. S. Atomic Energy Commission). U. S. Patent 2,806,764. Sept. 17, 1957.

A process is described wherein an anionic exchange technique is employed to separate uranium from a large variety of impurities. Very efficient and economical purification of contaminated uranium can be achieved by treatment of the contaminated uranium to produce a solution containing a high concentration of chloride. Under these conditions the uranium exists as an anionic chloride complex. Then the uranium chloride complex is adsorbed from the solution on an anionic exchange resin, whereby a portion of the impurities remain in the solution and others are retained with the uranium by the resin. The adsorbed impurities are then removed by washing the resin with pure concentrated hydrochloric acid, after which operation the uranium is eluted with pure water yielding an acidic uranyl chloride solution of high purity.

4593

PROCESS FOR RECOVERY OF URANIUM AND VANADIUM FROM CARBONATE SOLUTIONS BY REDUCTION–PRECIPITATION. D. A. Ellis and R. O. Lindblom (to U. S. Atomic Energy Commission). U. S. Patent 2,807,518. Sept. 24, 1957.

A process employing carbonate leaching of ores and an advantageous method of recovering the uranium and vanadium from the leach solution is described. The uranium and vanadium can be precipitated from carbonate leach solutions by reaction with sodium amalgam leaving the leach solution in such a condition that it is economical to replenish for recycling. Such a carbonate leach solution is treated with a dilute sodium amalgam having a sodium concentration within a range of about 0.01 to 0.5% of sodium. Efficiency of the treatment is dependent on at least three additional factors, intimacy of contact of the amalgam with the leach solution, rate of addition of the amalgam and exclusion of oxygen (air).

4594

PROCESS FOR THE PRODUCTION OF AN ACTIVATED FORM OF UO_2. M. J. Polissar (to U. S. Atomic Energy Commission). U. S. Patent 2,807,519. Sept. 24, 1957.

A process for producing a highly active form of UO_2 characterized both by rapid oxidation in air and by rapid chlorination with CCl_4 vapor at an elevated temperature is reported. In accordance with the process, commercial UO_2, is subjected to a series of oxidation-reduction operations to produce a form of UO_2 of enhanced reactivity. By treating commercial UO_2 at a temperature between 335 and 485°C with methane, then briefly with an oxygen containing gas and following this by a second treatment with a methane containing gas, the original relatively stable charge of UO_2 will be transformed into an active form of UO_2.

4595

SOLVENT EXTRACTION PROCESS. A. A. Jonke (to U. S. Atomic Energy Commission). U. S. Patent 2,809,091. Oct. 8, 1957.

An improved solvent extraction process is described for the extraction of metal values from highly dilute aqueous solutions. The process comprises contacting an aqueous

solution with an organic substantially water-immiscible solvent, whereby metal values are taken up by a solvent extract phase; scrubbing the solvent extract phase with an aqueous scrubbing solution; separating an aqueous solution from the scrubbed solvent extract phase; and contacting the scrubbed solvent phase with an aqueous medium whereby the extracted metal values are removed from the solvent phase and taken up by said medium to form a strip solution containing said metal values, the aqueous scrubbing solution being a mixture of strip solution and an aqueous solution which contains mineral acids anions and is free of the metal values. The process is particularly effective for purifying uranium, where one starts with impure aqueous uranyl nitrate, extracts with tributyl phosphate dissolved in carbon tetrachloride, scrubs with aqueous nitric acid and employs water to strip the uranium from the scrubbed organic phase.

4596

PROCESS FOR PRODUCING URANIUM HEXAFLUORIDE. R. D. Fowler (to U. S. Atomic Energy Commission). U. S. Patent 2,810,626. Oct. 22, 1957.

A process for the production of uranium hexafluoride from the oxides of uranium is reported. In accordance with the method the higher oxides of uranium may be reduced to uranium dioxide (UO_2), the latter converted into uranium tetrafluoride by reaction with hydrogen fluoride, and the UF_4 converted to UF_6 by reaction with a fluorinating agent. The UO_3 or U_3O_8 is placed in a reaction chamber in a copper boat or tray enclosed in a copper oven, and heated to 500 to 650°C while hydrogen gas is passed through the oven. The oven is then swept clean of hydrogen and the water vapor formed by means of nitrogen and then while continuing to maintain the temperature between 400 and 600°C, anhydrous hydrogen fluoride is passed through. After completion of the conversion to uranium tetrafluoride, the temperature of the reaction chamber is lowered to about 400°C, and elemental fluorine is used as the fluorinating agent for the conversion of UF_4 into UF_6. The fluorine gas is passed into the chamber, and the UF_6 formed passes out and is delivered to a condenser.

4597

METHOD OF PROCESSING MONAZITE SAND. G. D. Calkins (to U. S. Atomic Energy Commission). U. S. Patent 2,811,411. Oct. 29, 1957.

A method is given for the pretreatment of monazite sand with sodium hydroxide. When monazite sand is reacted with sodium hydroxide, the thorium, uranium, and rare earths are converted to water-insoluble hydrous oxides; but in the case of uranium, the precipitate compound may at least partly consist of a slightly soluble uranate. According to the patent, monazite sand is treated with an excess of aqueous sodium hydroxide solution, and the insoluble compounds of thorium, uranium, and the rare earths are separated from the aqueous solution. This solution is then concentrated causing sodium phosphate to crystallize out. The crystals are removed from the remaining solution, and the solution is recycled for reaction with a new supply of monazite sand.

4598

METHOD OF RECOVERING URANIUM COMPOUNDS. R. H. Poirier (to U. S. Atomic Energy Commission). U. S. Patent 2,811,412. Oct. 29, 1957.

The recovery of uranium compounds which have been adsorbed on anion exchange resins is discussed. The uranium and thorium-containing residues from monazite processed by alkali hydroxide are separated from solution, and leached with an alkali metal carbonate solution, whereby the uranium and thorium hydroxides are dissolved. The carbonate solution is then passed over an anion exchange resin causing the uranium to be adsorbed while the thorium remains in solution. The uranium may be recovered by contacting the uranium-holding resin with an aqueous ammonium carbonate solution whereby the uranium values are eluted from the resin, and then heating the eluate whereby carbon dioxide and ammonia are given off, the pH value of the solution is lowered, and the uranium is precipitated.

4599

PROCESS FOR PRODUCING URANIUM HALIDES. E. V. Murphree (to U. S. Atomic Energy Commission). U. S. Patent 2,811,414. Oct. 29, 1957.

A process and associated apparatus for producing UF_4 from U_3O_8 by a "fluidized" technique are reported. The U_3O_8 is first reduced to UO_2 by reaction with hydrogen, and the lower oxide of uranium is then reacted with gaseous HF to produce UF_4. In each case the reactant gas is used, alone or in combination with inert gases, to "fluidize" the finely divided reactant solid. The complete setup of the plant equipment including bins, reactor and the associated piping and valving, is described. An auxiliary fluorination reactor allows for the direct production of UF_6 from UF_4 and fluorine gas, or if desired, UF_4 may be collected as the product.

4600

FLUORINATION PROCESS. T. S. McMillan (to U. S. Atomic Energy Commission). U. S. Patent 2,811,413. Oct. 29, 1957.

A process for the fluorination of uranium metal is described. It is known that uranium will react with liquid chlorine trifluoride but the reaction proceeds at a slow rate. However, a mixture of a halogen trifluoride together with hydrogen fluoride reacts with uranium at a significantly faster rate than does a halogen trifluoride alone. Bromine trifluoride is suitable for use in the process, but chlorine trifluoride is preferred. Particularly suitable is a mixture of ClF_3 and HF having a mole ratio (moles ClF_3/moles HF) of about 0.3.

4601

PROCESS OF REMOVING PLUTONIUM VALUES FROM SOLUTION WITH GROUP IVB METAL PHOSPHO-SILICATE COMPOSITIONS. E. R. Russell, A. W. Adamson, J. Schubert, and G. E. Boyd (to U. S. Atomic Energy Commission). U. S. Patent 2,811,416. Oct. 29, 1957.

A process for separating plutonium values from aqueous solutions which contain the plutonium in minute concentrations is described. These values can be removed from an aqueous solution by taking an aqueous solution containing a salt of zirconium, titanium, hafnium or thorium, adding an aqueous solution of silicate and phosphoric acid anions to the metal salt solution, and separating, washing and drying the precipitate which forms when the two solutions are mixed. The aqueous plutonium containing solution is then acidified and passed over the above described precipitate causing the plutonium values to be adsorbed by the precipitate.

4602

REDISTRIBUTOR FOR LIQUID–LIQUID EXTRACTION COLUMNS. J. G. Bradley (to U. S. Atomic Energy Commission). U. S. Patent 2,811,423. Oct. 29, 1957.

An improved baffle plate construction to intimately mix immiscible liquid solvents for solvent extraction processes in a liquid-liquid pulse column is described. To prevent the light and heavy liquids from forming separate continuous homogeneous vertical channels through sections of the column, a baffle having radially placed rectangular louvers with deflection plates opening upon alternate sides

of the baffle is placed in the column, normal to the axis. This improvement substantially completely reduces stripping losses due to poor mixing.

Engineering

4603

NON-DESTRUCTIVE METHOD AND MEANS FOR FLAW DETECTION. (To U. K. Atomic Energy Authority (U.S.A.)). British Patent 781,121. Nuclear Eng. 3, 42(1958) Jan.

An alternating homogeneous magnetic field is established in the article under test, e.g. by arranging the article between a pair of coils, and a probe element aligned adjacent the article until zero output current is induced in the probe. The entire surface of the article is then scanned with the probe, e.g. by turning the article between the coils and moving it past the probe, or by moving the probe unit along the article. Any output current indicates size and location of flaws (or voids between layers of Bundy tubing).

4604

BLADED IMPELLER FOR TURBOBLOWERS. K. Baumann (to U. S. Atomic Energy Commission). U. S. Patent 2,483,610. Oct. 4, 1949.

A means is given of holding open-sided impeller blades in a turbo-rotor. Two half blades, with dovetail roots of sufficient weight to contain the center of gravity, are fitted into slots cut in the rotor so as to form the desired angle between the blade faces. The adjoining edges of the half blades are welded to form one solid blade that is securely locked in the rotor. This design permits the manufacture of a V shaped impeller blade without the need of machining the entire V shaped contour from a single blank, and furthermore provides excellent locking characteristics for attachment to the rotor.

4605

INDICATING, RECORDING, AND CONTROLLING APPARATUS. C. H. Gregory and J. Hall (to U. S. Atomic Energy Commission). U. S. Patent 2,535,202. Dec. 26, 1950.

An accurate and sensitive apparatus for indicating the difference between two fluid pressures is described. The specific device suspended from flexible strip type springs to control the fluid pressure in a main line. The mechanical linkage is biased in a position by the pressure from the two sources under measurement, the pressures acting in opposite directions on the linkage. A second pressure acts on the linkage derived from the main line, such that a change in the pressure differential between the two measured lines will move the linkage to change the valve flow, altering the main line pressure which in turn repositions the linkage. By metering the main line pressure, the pressure differential between the two lines is continuously monitored and measured.

4606

ANTI-SWING CRANE. R. C. Goertz (to U. S. Atomic Energy Commission). U. S. Patent 2,806,610. Sept. 17, 1957.

A device that reduces or eliminates the swing of an object being transported by a traveling crane is described. The supporting cable of the crane extends through a guide and follower positioned below the crane by an electric motor and follow-up circuit. The swing or horizontal motion of the cable is detected by the follower, and a signal is generated that will cause the motor to move the follower in opposition to the motion of the swing thus having a dampening effect on the pendulum action of the supported body. This improvement is particularly valuable when the supported load may be so radioactive that a person could not manually stop the swing.

Mineralogy, Metallurgy, and Ceramics

4607

PRESSURE WELDING OF TITANIUM OR ZIRCONIUM OR AN ALLOY BASED ON SUCH METAL. G. A. Geach and J. E. Hughes (to Associated Electrical Industries, Ltd.). British Patent 780,420. Nuclear Eng. 3, 42(1958) Jan.

It has been discovered that titanium and certain titanium-based alloys can be united to titanium or certain titanium-based alloys by application of pressure without heating to fusion point. Preliminary tests have also shown that a similar action is possible with zirconium. For joining titanium or zirconium or their alloys and a metal such as copper, iron, aluminum, nickel or their alloys the same method can be used, i.e. pressing continuous clean surfaces together with sufficient force (100 ton/in.^{2}) to produce a certain reduction in thickness resulting in welding the metals together without heat. Aluminum must be reduced to about 35% of its original thickness, copper and lead to about 20%, iron to about 10%, other metals to between 5% and 10%. For titanium and zirconium the figure is about 30%.

4608

SINTERED REFRACTORY MASS. Albert E. Williams (to U. S. Atomic Energy Commission). U. S. Patent 2,717,225. Sept. 6, 1955.

A method is given for joining sintered masses of refractory compounds. It consists in maintaining the masses in contact with each other by application of a moderate pressure, while they are at sintering temperature. The sintered masses are subjected to an applied pressure of about ½ to 1 ton per square inch of the surface in contact for about 10 minutes, and the temperature employed may be from about 1400°C to 2000°C. Refractory oxides to which the invention may be applied are beryllia, alumina, thoria, and magnesia.

4609

WELDING PROCESS. J. Zambrow and H. Hausner (to U. S. Atomic Energy Commission). U. S. Patent 2,807,082. Sept. 24, 1957.

A method of joining metal parts for the preparation of relatively long, thin fuel element cores of uranium or alloys thereof for nuclear reactors is described. The process includes the steps of cleaning the surfaces to be jointed, placing the surfaces together, and providing between and in contact with them, a layer of a compound in finely divided form that is decomposable to metal by heat. The fuel element members are then heated at the contact zone and maintained under pressure during the heating to decompose the compound to metal and sinter the members and reduced metal together producing a weld. The preferred class of decomposable compounds are the metal hydrides such as uranium hydride, which release hydrogen, thus providing a reducing atmosphere in the vicinity of the welding operation.

4610

METHOD OF ALLOYING REACTIVE METALS WITH ALUMINUM OR BERYLLIUM. O. J. C. Runnalls (to U. S. Atomic Energy Commission). U. S. Patent 2,809,887. Oct. 15, 1957.

A halide of one or more of the reactive metals, neptunium, cerium and americium, is mixed with aluminum or beryllium. The mass is heated at 700 to 1200°C, while maintaining a substantial vacuum of above 10^{-3} mm of mercury or better, until the halide of the reactive metal is reduced and the metal itself alloys with the reducing metal. The reaction proceeds efficiently due to the volatilization of the halides of the reducing metal, aluminum or beryllium.

Physics

4611

NUCLEAR REACTOR PROVIDED WITH A NEUTRON FLUX MEASUREMENT DEVICE. (To Commissariat à l'Energie Atomique (France)). British Patent 780,219. Nuclear Eng. 3, 42(1958) Jan.

In order to measure low levels of neutron flux (reactor out of operation) as well as high levels of neutron flux (normal working) a fixed shield is arranged between the active part of the reactor (within the shielding envelope) and the measurement device. This shield is made of a material having a high mass absorption coefficient for gamma rays, but a small absorption cross section for neutrons, and practically no secondary gamma radiation. Such a material is preferably bismuth. A second retractable shield may be interposed having a large absorption cross section for neutrons.

4612

IONIZATION CHAMBERS. (To Commissariat à l'Energie Atomique (France)). British Patent 780,283. Nuclear Eng. 3, 42(1958) Jan.

Leakage resistance between electrodes is reduced when the electrodes are arranged one inside the other, and a voltage source (dry battery) is disposed within the chamber; one terminal being connected to the inner electrode, the other to a conductor passing through the wall of the chamber. The external circuit is formed between this conductor and the outer electrode.

4613

ELECTRONIC APPARATUS. I. S. B. Eppstein. British Patent 780,736. Nuclear Eng. 3, 42(1958) Jan.

A pulse generator for producing pulses randomly distributed in time is described. The mean pulse repetition frequency (p.r.f.) can be stabilized at any desired value over a wide range. A detector of radioactive energy applies pulses to an amplifier producing pulses exceeding a predetermined value. These pulses are then fed to a circuit which produces a control voltage varying with the mean p.r.f. which, in its turn, varies the sensitivity of the detector to maintain the p.r.f. at a more nearly constant value. In one form of the invention, beta particles emitted by a radioactive source (strontium-90) are converted into electrical pulses by means of a fluorescent screen and a photomultiplier tube.

4614

THICKNESS MEASURING GAUGES USING RADIOACTIVE MATERIAL. W. E. Thompson and L. E. Taylor. British Patent 781,068. Nuclear Eng. 3, 42(1958) Jan.

The gage is useful especially for controlling the thickness of coatings on a moving sheet, e.g. of paper. The sheet passes first uncoated through one gage, then coated through a second gage. The output circuits are connected and produce a control current affecting the rate of travel. The radioactive source used in such gages is subject to decay and contamination and the ionization chamber is also subject to contamination so that the output from the ionization chamber falls with time. To maintain a true indication the balance between the outputs has to be adjusted periodically. This is done by a standardization procedure in which both gages are measuring standard material (air). The output from the ionization chamber is compared with a standard voltage. First in order to compensate for different contamination, the spacing of source and detector is adjusted. Then to compensate for decay of the source and contamination, the standard voltages, which are derived from potentiometers, are varied by adjusting the potentiometers. The necessary switching operations are preferably automatic and time-controlled (30 min intervals). As a permanent absorber, a polythene cover is used for the ionization chamber. This can be replaced periodically to reduce the effect of contamination.

4615

REDUCTION OF THE MOMENTUM OF FALLING BODIES. J. W. Kendall and I. H. Morrison (to U. S. Atomic Energy Commission). U. S. Patent 2,689,629. Sept. 21, 1954.

A means for catching free falling bodies that may be damaged upon impact is given. Several layers of floating gas-filled rubber balls are contained within a partially compartmented tank of liquid. The compartment extends from beneath the surface of the liquid to that height necessary to contain the desired number of layers of the balls. The balls and the liquid itself break the force of the fall by absorbing the kinetic energy of falling body. The body may then be retrieved from the floor of the tank by a rake that extends from outside of the tank through the free surface area and underneath the compartment wall. This arrangement is particularly useful in collecting irradiated atomic fuel rods that are discharged from a reactor at considerable height without damaging the thin aluminum jacket of the rods.

4616

TIMING APPARATUS. A. E. Bennett and John C. H. Geisow (to U. S. Atomic Energy Commission). U. S. Patent 2,742,085. Apr. 17, 1956.

The timing device comprises an escapement wheel and pallet, a spring drive to rotate the escapement wheel to a zero position, means to wind the pretensioned spring proportional to the desired signal time, and a cam mechanism to control an electrical signal switch by energizing the switch when the spring has been wound to the desired position, and deenergizing it when it reaches the zero position. This device produces an accurately timed signal variably within the control of the operator.

4617

CURRENT TRANSFER SYSTEMS. D. A. Watt (to U. S. Atomic Energy Commission). U. S. Patent 2,753,476. July 3, 1956.

A current transfer system is described for transferring current between a rotating member and a co-axial stationary member. The particular area of application for the invention is in connection with homopolar generators where a low voltage and high current are generated. The current transfer system of the invention comprises a rotor member and a co-axial stator member wherein one of the members is shaped to provide a circumferential surface concave in section and the other member is shaped to have a peripheral portion in close proximity to the surface, whereby a liquid metal can be stably supported between the two members when they are moving relative to one another to establish an electrical conducting path between the members.

4618

STABILIZED FEEDBACK AMPLIFIER. H. L. Fishbine and C. Sewell, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,802,070. Aug. 6, 1957.

Negative feedback amplifiers, and particularly a negative feedback circuit which is economical on anode power consumption, are described. Basically, the disclosed circuit comprises two tetrode tubes where the output of the first tube is capacitance coupled to the grid of the second tube, which in turn has its plate coupled to the cathode of the first tube to form a degenerative feedback circuit. Operating potential for screen of the second tube is supplied by connecting the cathode resistor of the first tube to the screen, while the screen is by-passed to the cathode of its tube for the amplified frequencies. Also, the amplifier incorporates a circuit to stabilize the transconductance of

the tubes by making the grid potential of each tube interdependent on anode currents of both tubes by voltage divider circuitry.

4619

METHOD AND APPARATUS FOR COLLECTING ISOTOPES. W. E. Leyshon (to U. S. Atomic Energy Commission). U. S. Patent 2,802,108. Aug. 6, 1957.

A method and apparatus for collecting isotopes having a high vapor pressure, such as isotopes of mercury, in a calutron are described. Heretofore, the collected naterial would vaporize and escape from the ion receiver as fast as it was received. By making the receiver of pure silver, the mercury isotopes form a nonvolatile amalgam with the silver at the water cooled temperature of the receiver, and the mercury is thus retained.

4620

AUTOMATIC COUNTING APPARATUS. W. D. Howell (to U. S. Atomic Energy Commission). U. S. Patent 2,803,405. Aug. 20, 1957.

An apparatus for automatically recording the results of counting operations on trains of electrical pulses is described. The disadvantages of prior devices utilizing the two common methods of obtaining the count rate are overcome by this apparatus; in the case of time controlled operation, the disclosed system automatically records any information stored by the scaler but not transferred to the printer at the end of the predetermined time controlled operations and, in the case of count controlled operation, provision is made to prevent a weak sample from occupying the apparatus for an excessively long period of time.

4621

REACTOR UNLOADING MEANS. C. M. Cooper (to U. S. Atomic Energy Commission). U. S. Patent 2,803,601. Aug. 20, 1957.

A means for remotely unloading irradiated fuel slugs from a neutronic reactor core and conveying them to a remote storage tank is reported. The means shown is specifically adapted for use with a reactor core wherein the fuel slugs are slidably held in end to end abutting relationship in the horizontal coolant flow tubes, the slugs being spaced from the internal walls of the tubes to permit continuous circulation of coolant water therethrough. A remotely operated plunger at the charging ends of the tubes is used to push the slugs through the tubes and out the discharge ends into a special slug valve which transfers the slug to a conveying tube leading into a storage tank. Water under pressure is forced through the conveying tube to circulate around the slug to cool it and also to force the slug through the conveying tube into the storage tank. The slug valve and conveying tube are shielded to prevent any harmful effects caused by the radioactive slug in its travel from the reactor to the storage tank. With the disclosed apparatus, all the slugs in the reactor core can be conveyed to the storage tank shortly after shutdown by remotely located operating personnel.

4622

ONE SHAKE GATE FORMER. R. Kalibjian and V. Perez-Mendez (to U. S. Atomic Energy Commission). U. S. Patent 2,803,748. Aug. 20, 1957.

An improved circuit for forming square pulses having substantially short and precise durations is described. The gate forming circuit incorporates a secondary emission R. F. pentode adapted to receive input trigger pulses and having a positive feedback loop connected from the dynode to the control grid to maintain conduction in response to trigger pulses. A short circuited pulse delay line is employed to precisely control the conducting time of the tube and a circuit for squelching spurious oscillations is provided in the feedback loop.

4623

ELECTROMAGNETIC APPARATUS FOR MOVING A ROD. J. N. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,803,761. Aug. 20, 1957.

An electromagnetic device for moving an object in a linear path by increments is described. The device is specifically adapted for moving a neutron absorbing control rod into and out of the core of a reactor and consists essentially of an extension member made of magnetic material connected to one end of the control rod and mechanically flexible to grip the walls of a sleeve member when flexed, a magnetic sleeve member coaxial with and slidable between limit stops along the flexible extension, electromagnetic coils substantially centrally located with respect to the flexible extension to flex the extension member into gripping engagement with the sleeve member when energized, moving electromagnets at each end of the sleeve to attract the sleeve when energized, and a second gripping electromagnet positioned along the flexible extension at a distance from the previously mentioned electromagnets for gripping the extension member when energized. In use, the second gripping electromagnet is deenergized, the first gripping electromagnet is energized to fix the extension member in the sleeve, and one of the moving electromagnets is energized to attract the sleeve member toward it, thereby moving the control rod.

4624

GAUGING APPARATUS. C. A. Ruggles (to U. S. Atomic Energy Commission). U. S. Patent 2,803,885. Aug. 27, 1957.

A swinging arm gage designed to measure radial angles, tapering, sloping, or arcuate concave surfaces is described. The principle of the swinging arm gage is that in any spherical system, radii and radial lines established by them pass through the center of the sphere. Thus if an arm be made to pivot at the sphere center, the path of the swinging end can be guided by a cam so set as to establish the proper center angle, and dial indicators on the arm can be zeroed on a master object, angular and dimensional manufacturing errors can be determined on a duplicate object. This device makes possible a considerable saving of time in measuring complex arcuate contours.

4625

AUTOMATIC LIGHT CONTROL. M. Artzt (to U. S. Atomic Energy Commission). U. S. Patent 2,804,550. Aug. 27, 1957.

A control system for a projection kinescope used in a facsimile scanning system and, in particular, means for maintaining substantially constant the light emanating from the flying spot on the face of the kinescope are described. In general, the invention provides a feeler member disposed in such a position with respect to a projecting lens as to intercept a portion of the light striking the lens. Suitable circuitry in conjunction with a photomultiplier tube provides a signal proportional to the light intensity of the flying spot. The grid bias on the kinescope is controlled by this signal to maintain the intensity of the spot substantially constant.

4626

GAS DISCHARGE DEVICES. W. J. Arrol and S. Jefferson (to U. S. Atomic Energy Commission). U. S. Patent 2,804,573. Aug. 27, 1957.

The construction of gas discharge devices where the object is to provide a gas discharge device having a high dark current and stabilized striking voltage is described. The inventors have discovered that the introduction of tritium gas into a discharge device with a subsequent electrical discharge in the device will deposit tritium on the inside of the

chamber. The tritium acts to emit beta rays and is an effective and non-hazardous way of improving the above-mentioned discharge tube characteristics

4627

COASTING ARC ION SOURCE. J. S. Foster, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,806,161. Sept. 10, 1957.

An improved ion source is described and in particular a source in which the ions are efficiently removed. The plasma is generated in a tubular anode structure by the oscillation of electrons in an axial magnetic field, as in the Phillips Ion Gage. The novel aspect of the source is the expansion of the plasma as it leaves the anode structure, so as to reduce the ion density at the axis of the anode and present a uniform area of plasma to an extraction grid. The structure utilized in the present patent to expand the plasma comprises flange members of high permeability at the exit-grid end of the anode to diverge the magnetic field adjacent the exit.

4628

LIGHT WATER MODERATED NEUTRONIC REACTOR. R. F. Christy and A. M. Weinberg (to U. S. Atomic Energy Commission). U. S. Patent 2,806,819. Sept. 17, 1957.

A uranium fuel reactor designed to utilize light water as a moderator is described. The reactor core is in a tank at the bottom of a substantially cylindrical cross-section pit, the core being supported by an apertured grid member and comprised of hexagonal tubes each containing a plurality of fuel rods held in a geometrical arrangement between end caps of the tubes. The end caps are apertured to permit passage of the coolant water through the tubes and the fuel elements are aluminum clad to prevent corrosion. The tubes are hexagonally arranged in the center of the tank providing an annulus between the core and tank wall which is filled with water to serve as a reflector. In use, the entire pit and tank are filled with water in which is circulated during operation by coming in at the bottom of the tank, passing upwardly through the grid member and fuel tubes and carried off near the top of the pit, thereby picking up the heat generated by the fuel elements during the fission thereof. With this particular design, the light water coolant can also be used as the moderator when the uranium is enriched by fissionable isotope to an abundance of U^{235} between 0.78% and 2%.

4629

NEUTRONIC REACTOR. E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,806,820. Sept. 17, 1957.

A reactor of the type having coolant liquid circulated through clad fuel elements geometrically arranged in a solid moderator, such as graphite, is described. The core is enclosed in a pressure vessel and suitable shielding, wherein means is provided for circulating vapor through the core to superheat the same. This is accomplished by drawing off the liquid which has been heated in the core due to the fission of the fuel, passing it to a nozzle within a chamber where it flashes into a vapor, and then passing the vapor through separate tubes extending through the moderator to pick up more heat developed in the core due to the fission of the fuel, thereby producing superheated vapor.

4630

QUARTZ FIBER ELECTROSCOPES. R. P. Henderson (to U. S. Atomic Energy Commission). U. S. Patent 2,806,960. Sept. 17, 1957.

An instrument carried unobtrusively about the person such as in a finger ring to indicate when that person has been exposed to an unusual radiation hazard is described. A metallized quartz fiber is electrically charged to indicate a full scale reading on an etched glass background. The quartz fiber and the scale may be viewed through a magnifying lens for ease of reading. Incident radiation will ionize gaseous particles in the sealed structure thereby allowing the charge to leak off the quartz fiber with its resulting movement across the scale proportionally indicating the radiation exposure.

4631

THERMAL NUCLEAR REACTOR. F. W. Fenning and R. F. Jackson (to U. S. Atomic Energy Commission). U. S. Patent 2,807,580. Sept. 24, 1957.

Nuclear reactors of the graphite moderated air cooled type in which canned slugs or rods of fissile material are employed are discussed. Such a reactor may be provided with a means for detecting dust particles in the exhausted air. The means employed are lengths of dust absorbent cord suspended in vertical holes in the shielding structure above each vertical coolant flow channel to hang in the path of the cooling air issuing from the channels, and associated spindles and drive motors for hauling the cords past detectors, such as Geiger counters, for inspecting the cords periodically. This design also enables detecting the individual channel in which a fault condition may have occurred.

4632

NEUTRONIC REACTOR. E. Fermi and L. Szilard (to U. S. Atomic Energy Commission). U. S. Patent 2,807,581. Sept. 24, 1957.

Reactors of the type employing plates of natural uranium in a moderator are discussed wherein the plates are uniformly disposed in parallel relationship to each other thereby separating the moderator material into distinct and individual layers. Each plate has an uninterrupted surface area substantially equal to the cross-sectional area of the active portion of the reactor, the particular size of the plates and the volume ratio of moderator to uranium required to sustain a chain reaction being determinable from the known purity of these materials and other characteristics such as the predictable neutron losses due to the formation of radioactive elements of extremely high neutron capture cross section.

4633

PULSE GENERATOR. C. W. Roeschke (to U. S. Atomic Energy Commission). U. S. Patent 2,807,722. Sept. 24, 1957.

An improvement in pulse generators is described by which there are produced pulses of a duration from about 1 to 10 microseconds with a truly flat top and extremely rapid rise and fall. The pulses are produced by triggering from a separate input or by modifying the current to operate as a free-running pulse generator. In its broad aspect, the disclosed pulse generator comprises a first tube with an anode capacitor and grid circuit which controls the firing; a second tube series connected in the cathode circuit of the first tube such that discharge of the first tube places a voltage across it as the leading edge of the desired pulse; and an integrator circuit from the plate across the grid of the second tube to control the discharge time of the second tube, determining the pulse length.

4634

HIGH POWER PULSED OSCILLATOR. S. Singer and L. K. Neher (to U. S. Atomic Energy Commission). U. S. Patent 2,807,723. Sept. 24, 1957.

A high powered, radio frequency pulse oscillator is described for generating trains of oscillations at the instant an input direct voltage is impressed, or immediately upon application of a light pulse. In one embodiment, the pulse oscillator comprises a photo-multiplier tube with the cathode connected to the first dynode by means of a resis-

tor, and adjacent dynodes are connected to each other through adjustable resistors. The ohmage of the resistors progressively increases from a very low value for resistors adjacent the cathode to a high value adjacent the plate, the last dynode. Oscillation occurs with this circuit when a high negative voltage pulse is applied to the cathode and the photo cathode is bombarded. Another embodiment adds capacitors at the resistor connection points of the above circuit to increase the duration of the oscillator train.

4635

NEUTRONIC REACTOR SHIELD. E. Fermi and W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,807,727. Sept. 24, 1957.

The reactor radiation shield material is comprised of alternate layers of iron-containing material and compressed cellulosic material, such as masonite. The shielding material may be prefabricated in the form of blocks, which can be stacked together in any desired fashion to form an effective shield.

4636

LINE-ABOVE-GROUND ATTENUATOR. R. B. Wilds and J. R. Ames (to U. S. Atomic Energy Commission). U. S. Patent 2,807,785. Sept. 24, 1957.

The line-above-ground attenuator provides a continuously variable microwave attenuator for a coaxial line that is capable of high attenuation and low insertion loss. The device consists of a short section of the line-above-ground plane type transmission line, a pair of identical rectangular slabs of lossy material like polyiron, whose longitudinal axes are parallel to and indentically spaced away from either side of the line, and a geared mechanism to adjust and maintain this spaced relationship. This device permits optimum fineness and accuracy of attenuator control which heretofore has been difficult to achieve.

4637

ELECTRONIC DIGITAL COMPUTER. J. J. Stone, Jr., E. S. Bettis, and E. R. Mann (to U. S. Atomic Energy Commission). U. S. Patent 2,808,986. Oct. 8, 1957.

The electronic digital computer is designed to solve systems involving a plurality of simultaneous linear equations. The computer can solve a system which converges rather rapidly when using Von Seidel's method of approximation and performs the summations required for solving for the unknown terms by a method of successive approximations.

4638

NEUTRONIC REACTOR. H. E. Metcalf (to U. S. Atomic Energy Commission). U. S. Patent 2,809,157. Oct. 8, 1957.

A reactor of the type which preferably uses plutonium as the fuel and a liquid moderator, preferably ordinary water, and which produces steam within the reactor core due to the heat of the chain reaction is described. In the reactor shown, the fuel elements are essentially in the form of trays and are vertically stacked in spaced relationship. The water moderator is continuously supplied to the trays to maintain a constant level on the upper surfaces of the fuel element as it is continually evaporated by the heat. The steam passes out through the spaces between the fuel elements and is drawn off at the top of the core. The fuel elements are clad in aluminum to prevent deterioration thereof with consequent contamination of the water.

4639

NEUTRONIC REACTOR SYSTEM. F. Daniels (to U. S. Atomic Energy Commission). U. S. Patent 2,809,931. Oct. 15, 1957.

Gas-cooled solid-moderator type reactors wherein the fissionable fuel and moderator materials are each in the form of solid pebbles, or discrete particles, and are substantially homogeneously mixed in the proper proportion and placed within the core of the reactor are described. The shape of these discrete particles must be such that voids are present between them when mixed together. Helium enters the bottom of the core and passes through the voids between the fuel and moderator particles to absorb the heat generated by the chain reaction. The hot helium gas is drawn off the top of the core and may be passed through a heat exchanger to produce steam.

4640

FLUID MODERATED REACTOR. E. P. Wigner, L. A. Ohlinger, G. J. Young, and A. M. Weinberg (to U. S. Atomic Energy Commission). U. S. Patent 2,810,689. Oct. 22, 1957.

A reactor which utilizes fissionable fuel elements in rod form immersed in a moderator or heavy water and a means of circulating the heavy water so that it may also function as a coolant to remove the heat generated by the fission of the fuel are described. In this design, the clad fuel elements are held in vertical tubes immersed in heavy water in a tank. The water is circulated in a closed system by entering near the tops of the tubes, passing downward through the tubes over the fuel elements and out into the tank, where it is drawn off at the bottom, passed through heat exchangers to give up its heat and then returned to the tops of the tubes for recirculation.

4641

PULSE AMPLITUDE ANALYZER. G. W. Gray and A. S. Jensen (to U. S. Atomic Energy Commission). U. S. Patent 2,810,828. Oct. 22, 1957.

A pulse-height analyzer system of improved design for sorting and counting a series of pulses, such as provided by a scintillation detector in nuclear radiation measurements, is described. The analyzer comprises a main transmission line, a cathode-ray tube for each section of the line with its deflection plates acting as the line capacitance; means to bias the respective cathode ray tubes so that the beam strikes a target only when a prearranged pulse amplitude is applied, with each tube progressively biased to respond to smaller amplitudes; pulse generating and counting means associated with each tube to respond when the beam is deflected; a control transmission line having the same time constant as the first line per section with pulse generating means for each tube for initiating a pulse on the second transmission line when a pulse triggers the tube of corresponding amplitude response, the former pulse acting to prevent successive tubes from responding to the pulse under test. This arrangement permits greater deflection sensitivity in the cathode ray tube and overcomes many of the disadvantages of prior art pulse-height analyzer circuits.

4642

EXTRACTION METHOD FOR SEPARATING URANIUM, PLUTONIUM, AND FISSION PRODUCTS FROM COMPOSITIONS CONTAINING SAME. G. T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 2,811,415. Oct. 29, 1957.

Methods for separating plutonium from the fission products present in masses of neutron irradiated uranium are reported. The neutron irradiated uranium is first dissolved in an aqueous solution of nitric acid. The plutonium in this solution is present as plutonous nitrate. The aqueous solution is then agitated with an organic solvent, which is not miscible with water, such as diethyl ether. The ether extracts 90% of the uranyl nitrate leaving,

substantially all of the plutonium in the aqueous phase. The aqueous solution of plutonous nitrate is then oxidized to the hexavalent state, and agitated with diethyl ether again. In the ether phase there is then obtained 90% of plutonium as a solution of plutonyl nitrate. The ether solution of plutonyl nitrate is then agitated with water containing a reducing agent such as sulfur dioxide, and the plutonium dissolves in the water and is reduced to the plutonous state. The uranyl nitrate remains in the ether. The plutonous nitrate in the water may be recovered by precipitation.

4643

NEUTRON REACTOR HAVING A Xe^{135} SHIELD. H. E. Stanton (to U. S. Atomic Energy Commission). U. S. Patent 2,811,487. Oct. 29, 1957.

Shielding for reactors of the type in which the fuel is a chain reacting liquid composition comprised essentially of a slurry of fissionable and fertile material suspended in a liquid moderator is discussed. The neutron reflector comprises a tank containing heavy water surrounding the reactor, a shield tank surrounding the reflector, a gamma ray shield surrounding said shield tank, and a means for conveying gaseous fission products, particularly Xe^{135}, from the reactor chamber to the shield tank, thereby serving as a neutron shield by capturing the thermalized neutrons that leak outwardly from the shield tank.